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With a Supplement

on

ARE THE FILIPINOS READY FOR INDEPENDENCE?

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FOREWORD

THOSE with skill and experience who have written on aviation can be divided into two classes.

The first group includes those who write of dare-devil deeds and death-defying adventures, placing the subject on such a heroic plane that it frightens the ordinary individual into believing that in order to fly he must have had from birth all the essentials required to develop at maturity a super-man.

The second group—the technicians—know so much about the subject that they write as if learning to fly was as easy as learning to walk, and the only reason that everyone doesn't fly is because of neglectful parents who have overlooked this essential of early training.

In a few years the young man and even the young woman who has not learned to fly will be regarded as natural phenomena as today are those who cannot drive automobiles.

I mention this because I have observed that the average man in search of aeronautical information and dependent upon the ordinary channels to secure it, either finds himself delving into mysterious aerodynamic formulae that to the beginner are as useless as trigonometry to a rhinoceros in British East Africa; or discovers himself entranced by the many adventures of the intrepid birdman who has answered the "call of the air" at so much per word in the popular fiction magazines.

In collecting the material for this issue of *The Annals*, I have endeavored to secure from authentic sources such articles as would give the readers an understandable insight into an art that is destined to play a leading part in the life of the immediately coming generations, changing very materially many details of human civilization.

The Annals, a publication which from time to time has devoted itself to the greatest problems and aspirations of mankind, never has served a more important cause than now, when it exerts its efforts to arouse American interest in aeronautics, and never has touched a field more certain to be fertile if cultivated by intelligence and energy. Thus tilled this field, first opened to the world by American genius, will yield results of incalculable moment.

No greater service could be done for this great nation by the American Academy of Political and Social Science than to induce a general study in this art and business, nor is there any other subject I can think of so certain to yield profit to the student.

FRANK A. TICHENOR.

Human Flight Throughout the Ages

By Adrian Van Muffling
Aeronautical Engineer

As we look back through history, particularly the history of mythology and religion, we observe that the attainment of flight has ever been uppermost among the aspirations of man. In most mythologies and religious systems, the supreme beings who ruled the universe were given their abode in a vague region far above the earth, and the ability to soar the atmosphere at will became therefore, an essential attribute of godliness. Man could walk the earth and swim its waters; but he could not fly. Next to immortality, flying was the one element that differentiated a Deity from common mortals.

The Philosophy of the Ancients

To scientists and philosophers, the problem whether man would ever succeed in elevating himself by his own effort, presented itself with peculiar fascination. That there were two things in nature which possessed an inherent power to rise into the atmosphere—birds and smoke—was a matter of everyday observation. And when men began to speculate about their own possibilities, there immediately arose two distinct schools of aeronautical philosophy, which developed parallel to each other down to the present day. They can be traced throughout the ages, and balloons and aeroplanes are, in essence, the practical result of the ancient smoke-flight and bird-flight theory.

It is interesting to note that the ancients, who conceived their gods essentially as human-like beings, approached the subject with less qualms than the philosophers of the Middle Ages, when consideration of what might or might not be displeasing to a wrathful Deity was often a deterrent to all but the most intrepid of thinkers. The Inquisition, indeed, considered attempts at aerial navigation as a form of sorcery, and many documents that would be of inestimable value to us today were destroyed by its orders, and their authors variously punished. The argument was: that if God had intended men to fly he would have endowed them with wings. Now, angels, who flew, were divine beings, while devils, who also flew, were most decidedly not. Not being divine, any man who ever succeeded in flying could not possibly be inspired by angels; consequently he *must* be in league with the devil and be aided by him. Which is all logical enough, and hundreds of clever men were sent to the rack or the stake as a result of such reasoning.

Ancient Stories of Flights

The earliest stories of flights of which there is a record belong clearly in the realm of pure legend. Such is the tale of Deadalus, who is said to have flown from Crete, where he had been imprisoned for revealing the secrets of the Labyrinth which he had constructed for the king. It has been pointed out that his was probably the first attempt to adopt sails in Greek waters, the use of which he had observed in Egypt, and the astonished Cretans mistook for wings the first sails which they beheld. His son Icarus suffered shipwreck—hence the legend of his fall with which every

schoolboy is familiar. But a flying model "*in imitation of a dove made of wood . . . made to fly by regulated mechanics*," according to Aulus Gellius, is said to have been actually constructed some time before 360 B.C. Further references to flying are made by Plautus and Juvenal. And in 120 B.C. Samostathenes, in one of his satires, ridiculed the various means which had been suggested to enable men and ships to soar through the air; which shows that the idea of flying was fairly common at that early time.

That a certain Simon—often, but probably erroneously, identified with Simon Magus, the Apostate and opponent of St. Paul—succeeded in elevating himself into the air during the reign of Emperor Nero, is a story well authenticated by many writers of the time, both secular and apostolic. Tacitus specifies a "chariot of fire," and speaks of it as of a matter of common knowledge, and so does Macrobius. According to the early church writers, Simon undertook to prove a point in his argument against St. Paul, and ascended to some height to demonstrate that there was nothing supernatural in the story of the Transfiguration.

It is recorded that the ascension took place in the forum at Rome, and before a vast crowd which included the Apostle Peter. According to the legend the latter, incensed at such impiety, knelt down and prayed that Simon's temerity be punished, whereupon his chariot collapsed and he was killed by the fall. The story was repeated and improved upon by subsequent annalists and as usual did not lose in picturesqueness with each new version. If an account of the flight were not also given by sober, pagan historians, not influenced by religious bias, it might well be classed as legend, pure and simple.

If we weigh the probabilities, it seems not at all impossible, however, that a hot air balloon should have been constructed and actually made an ascension on that occasion. That smoke (*i.e.*, hot air) would rise was of course known. And the Romans, who were familiar with the art of weaving fine fabrics, and who carried on an extensive trade with the East, were certainly able to fashion a cloth or silk bag large enough to carry a man aloft. That an adventurous spirit should have been willing to make an actual test of his theories, and succeeded in rising high enough to be killed in the subsequent fall, is not unlikely. And it is also easily understandable that the early Christians, then just beginning to feel the first brunts of persecution, were thunderstruck at such audacity, and eagerly seized upon the occasion to turn it to their advantage, especially as it enabled them to demonstrate the power of their God by the spectacular public punishment of the most active opponent of their beliefs. There seems to be, therefore, no reason to believe that the story of the ascent of Simon, in a vehicle which probably resembled a modern balloon, is as mythical as it has been held to be by some subsequent writers.

THE MIDDLE AGES

During the Middle Ages scientific thought did not concern itself much with mechanical flight and mention of it is found only sporadically, such as the famous study of Roger Bacon on the flight of birds, written in 1256. This remarkable man clearly foresaw some of the difficulties that would have to be overcome, and in his prophetic vision he predicted not only the advent of the aeroplane but of the motor car as well, even going so far as to state unmistakably that the motive power would have to be derived from fire.

But it was not till the Renaissance brought along in its train a general quickening of scientific thought, that a serious study began to be made towards an understanding of the physical laws involved.

Early in the fifteenth century one Gianbattista Danti, professor of mathematics at Venice, constructed an apparatus evidently designed along the lines of a modern glider, with which he attempted a glide from the roof of a house in Perugia. According to the contemporary historian of the city:

. . . the day on which the nuptials of Paolo Baglioni were celebrated, and many principal lords had congregated to honor him, and lances were being broken in the street under his windows, he (Danti), unexpectedly and with a mass of wings which he had fashioned in proportion to the gravity of his body, removed himself from a tower nearby and, emitting a whistle most horrible to hear, flew happily over the big square filled with innumerable people.

According to the narrator, the flight ended with the collapse of the left wing and a fall on the roof of a nearby church, although Danti had acquired proficiency by flying several times from the bluffs overlooking Lake Trasimeno. Another version of the same event describes the population as so incensed at his temerity in attempting to emulate the angels, that his apparatus was burned and the "sorcerer" exiled from the city.

LEONARDO DA VINCI'S CONTRIBUTION

It was probably this attempt which caused Leonardo da Vinci to give serious consideration to the problem of flight. As a trained engineer, however, he realized the necessity, before he attempted actual construction of a flying machine, for a thorough theoretical investigation, which he gave to the world in 1505 under the name of "Codex on the Flight of Birds." This curious booklet, full of descriptions and sketches of birds and various forms of mechanical wings, has been preserved, and, like some of his other notebooks, is full of most interesting material.

We know that he was first to realize the proper relationship between wing-position and center of gravity, and to point out the fallacy still held in popular belief that a low center of gravity must of necessity result in an inherently stable mechanism. He also established the theory of the inclined plane, later mathematically investigated by Newton, and that there must be a resistance offered to advancement by the air if sustentation of an object is to occur. His explanation of the motion of a bird's wing has not hitherto been seriously challenged, and our present knowledge on that point has not materially progressed beyond his.

According to his designs, he attempted to imitate the mechanical structure of a bird's wing, and his conception of the mechanical principles involved, and the means by which complex motions were to be attained were quite sound. Even his calculations were, in the main, correct; but he underestimated the power required to operate his wings, doubtlessly for lack of suitable apparatus for research.

FRANCISCO LANA'S STUDY

Francisco Lana, an Italian Jesuit in 1670, published a study on the physical properties of air, which was far in advance of the general knowledge of his time. He described a method to weigh a given quantity of air and first deduced the principle of lighter-than-air flying craft. He proposed a vessel suspended from four hollow copper globes, from which the air was to be evacuated by filling them with water, and then allowing the latter to run out through a pipe over 34 feet long—a perfectly sound principle, assuming

that a vessel could be built strong enough to sustain the atmospheric pressure. His work concludes with the following prophetic words:

. . . and I can see no other difficulties that can be offered against this invention of mine excepting one which to me seems of more weight than all the others, and that is, that God shall never allow such a machine to be successful in practice, to prevent many consequences which would disturb civil and political intercourse among mankind. For who does not see that no city would be secure from surprises, as the ship could descend at any hour upon the very market place and from it issue men intent on ruin? And the same would happen in the courtyards of private houses and on the ships at sea, and even without descending could set the ships afire with fireworks, bullets and bombs, and not only ships, but houses, castles and cities, and those below would be without means of hurting those who dropped them from a great height.

In common with many other enlightened thinkers, who aimed to replace the religious obscurantism of their time with useful knowledge, this man, who considered it unsportsmanlike to attack defenseless cities unable to fight back, was brought before the dreaded Inquisition and tried for sorcery, but—strangely enough—was acquitted.

FIRST OFFICIAL RECOGNITION

The first official recognition ever given by a government to the inventor of a flying machine was granted to one Bartholomy de Guzmao by the King of Portugal, and when we remember that even today some very absurd and unpractical ideas are often patented, we need not wonder that this first aeronautical patent was granted to what is perhaps the strangest and weirdest idea of them all. For this invention consisted of a ship built of iron and filled with chopped straw, over the deck of which there stretched a horizontal sail or canopy. Ascensional force was to be derived by three distinct methods: 1. A current of air was to be generated by bellows within the hold to blow upwards against the canopy; 2. Two large globes of lodestone or magnetic iron mounted on deck were to attract the metal body of the ship; 3. A number of pieces of amber suspended above the deck were to be heated by torches, and thus, by a well-known principle of static electricity, cause the straw in the hold to rise towards them. Three perfectly good ways, so to speak, of lifting oneself by pulling one's own bootstraps.

The original patent granted by John V, of Portugal, is interesting as a document showing that the value of aircraft to any nation possessing it was well realized; also as an example of the thoroughness with which exclusive privileges were granted and what dire penalties were incurred by the hapless infringer. It is of sufficient interest to quote it here in its entirety from a French translation. Note how well the advantages of flying which we enjoy today were understood at the time.

WE, THE KING (follow titles), make known that Father Bartholomeo Lourenzo de Guzmao has addressed a petition wherein he declares that he has discovered an instrument designed to navigate in the airs in the same manner as on the ground and waters with far greater speed, covering a distance of 200 leagues a day. By this instrument one can deliver important messages to distant countries and troops almost at the same instant in which they are prepared, which interests us more than it does other sovereigns on account of the great extent of our possessions; one can avoid thereby the great distances of colonies, the news from which we always received too late; and furthermore, we can obtain all the necessities from said colonies much sooner and with greater speed; business men can exchange documents and capital with the same speed; all the beleaguered places can be assisted, with men as well as with provisions

at any moment; those who desire can be taken out from them without interference from the enemy; and one can discover the lands adjoining the two poles of the earth.

The glory of this discovery shall revert to the Portugese nation, a discovery which foreign nations shall vainly attempt to imitate. The real longitudes of the entire world shall be known, for the errors on geographical maps are the cause of many shipwrecks; and furthermore, other advantages will be useful to the world and shall merit our royal attention; as in connection with this useful invention many problems will present themselves, many crimes will be committed, and other crimes facilitated through the certainty of evading justice by flying into other lands.

The above shall be avoided if the use of it be reserved to one person to whom all orders connected with said transport shall be given, and forbidding its employ to all other under penalty of punishment. Because it is just to remunerate the author of such an important invention, he has asked us for the exclusive privilege to operate said invention, so that no one else can avail himself of it, at any moment, in this Kingdom and its colonies, under no pretext whatsoever without the permission of the author or his heirs, under penalty of forfeiting all his possessions, one-half of which shall go to the author of the petition and the other half to the denouncer; and under all other penalties that it shall please us to apply, which shall be enforced as soon as it shall be known that any other person is building a similar instrument, even if he has not used the same, unless the culpable one has placed himself beyond jurisdiction by escape.

In consideration of his proposals I accord to the author of said petition the privilege of the execution of his invention to any other's exclusion, who cannot make use of said invention under the penalties as above specified. Only the author of the petition shall have the right to the use of this invention, as is requested in said petition.

This patent shall be privileged and effective in all its provision beyond the term of one year, in spite of the contrary provisions in Chapter IV, book II of our Ordinances.

There has been paid to the treasurer of the court, 2 francs 50 cent. as provided on page 160, Vol. I. Registered on page 149, Vol. I. Jose Maria de Faria wrote this patent the 19th day of April, 1709. Manoel de Castro Guimaraes has revised and rewritten it.

Recieved 2 fr. 50. (*Signed*) *THE KING.*

According to well-authenticated reports, Guzmao is actually known to have made a flight in a machine of his construction shortly after the granting of the patent, in the presence of the court and a vast crowd. Details are lacking, but an eyewitness relates about "*. . . a globe containing fire which he himself had lighted.*" It is evident that the original idea had been abandoned and that the inventor entrusted himself to a hot air balloon. But it was a deed miraculous for all that; even the good graces of the King were unable to save him from the charge of sorcery, and in 1717, Guzmao was brought before the dreaded Holy Tribunal. All papers relating to the invention were publicly burned, including accounts of the flight that were discovered while the unfortunate inventor was condemned to a dungeon, and not only his mistress but all the women he had ever been known to speak to were accused of witchery. Eventually he succeeded in escaping to Spanish territory where he died shortly afterward.

THE EIGHTEENTH CENTURY

The annals of the eighteenth century contain many records of further attempts and scientific discoveries, each of which added to the store of knowledge and made the chances of ultimate success more real.

The story of how the first balloon ascension was made by the brothers Montgolfier in 1783 is too familiar to be retold here in great detail. What is not so generally known, is that before the year was over the physicist Charles invented most of the improvements that are still in use today, such as the "net" which distributes the

weight of the basket over the entire surface of the balloon, the safety valve, the rip cord to safeguard landings, and many others. Balloons were found to be very simple to construct and, keeping one for amusement being merely a matter of expense, ascensions became quite a popular sport among the French nobility prior to the Revolution. The spectacular new toy inflamed popular imagination and brought the usual exaggerations in its train. There arose a "cuisine au balloon," "voitures au balloon," and of course, "la mode au balloon," which was richly caricatured in the press of the time.

After that success the imagination of the inventors simply ran riot, and many of the devices of which records have been preserved are ludicrous in the extreme. Thus stock was sold for a dirigible balloon which was driven by a compressed air cannon. The body, suspended about thirty feet from the balloon proper, contained a compressor operated by a man-operated treadmill. A cannon would be loaded with a ball which was suspended by a chain from the balloon above; shooting the cannon would send the ball in any desired direction, and after the chain was taut its momentum was supposed to carry the whole contraption along for a while, during which time another similar ball was being loaded. A mattress on the bow of the boat was thoughtfully provided to receive the impact of the returning ball without damage. Another company was organized for the purpose of supplying tired Parisian business men with the bracing air of high altitudes without necessitating a trip to the mountains, simply by having a balloon, large enough to carry a house's population, ascend over the city every evening to be brought down again at dawn of the next day; all comforts of home being provided for, not forgetting a pipe organ for musical entertainment.

Aerial navigation having been accomplished in one form, interest in the development of flight by means of wings lagged for a time. Also, it had gradually been realized that man's muscular power is not sufficient to sustain him in the air. But after the steam engine was improved, thought began to be applied to the problem of harnessing the new force to aerial navigation. The design of an Englishman, Sir John Cayley, dated 1842, is the earliest of which we have detailed knowledge; and it shows how previous speculation had been well directed and how much had been learned by experience with gliders that this machine—which was never built, owing to the impossibility of obtaining an engine of sufficient power—was to embody the great majority of devices which made dynamic flight ultimately possible.

The Airplane

By Dr. Michael Watter, M.S.A.E.
Design Engineer, Chance Vought Corporation

THE outstanding event of the beginning of the twentieth century is the fulfillment of the age-long objective of man to conquer the air. On December 17, 1903, an object created by man's genius and resembling nothing that we know in nature, an object much heavier than the air, carried a man in his conquering flight of few seconds. A few seconds in 1903—seconds of anguished uncertainty, continuous danger, and tiresome efforts. Twenty years after peaceful flights, of hours and hours duration—oceans spanned and the earth girded by glorious flights. Only twenty years after! The gigantic strides of the youthful science is a deserved reward to those brave men who dared and won success.

Because of the absence of laboratories in the early days of flying, the theory of flight had to be studied by actual experiments. It was only later when scientists and engineers devoted their attention to this new method of locomotion that the practical results found theoretical explanation and technical coördination. Today aeronautics is a well-defined and extensive branch of pure and applied sciences. The airplane is strictly a technical product, created according to usual procedures of engineering. It is designed, calculated and manufactured, and its strength, capacity and performance are controllable and known before the production is even started.

There are five distinct groups of principal parts constituting an airplane: wings, stabilizing and controlling surfaces, power group, body, and landing gear. The wings sustain the craft in flight. Stabilizing and controlling surfaces are necessary to render the plane stable and steerable. The power group provides the motion of the craft in the air, which is the most important condition of sustention. The body houses the crew, passengers, and luggage. The landing gear serves in alighting and landing.

The aim of this article is to review these parts and in the light of our present knowledge to explain their working, history and probable future modifications.

Wings

A wing is a structure having a lateral dimension (span) from about four to twelve times greater than longitudinal one, (chord). The chord section of a wing resembles somewhat the wing of a bird. The form of this section, the airfoil, is the governing factor in the characteristics of a wing; it was evolved, in the beginning of flying, through methodical experimentation, but found its general explanation only in 1906. Professor Joukowsky of Russia, by a brilliant mathematical theorem, proved that wing profiles when invested by an air stream are subjected to an air force perpendicular to the original direction of the wind. This, however, is true only in what is known as the ideal fluid and for such wings whose span would be infinitely larger than the chord.

In actual practice these conditions are not fulfilled, and as a result the air force is inclined slightly backward so that we must consider two forces: one perpendicular to the direction of

the air stream, and called the "lift," and a second along the direction of relative wind, called the "drag." The lift is the sustaining force which enables us to fly, while the drag must be overcome by the thrust of the propeller.

In order to understand the lifting action of a wing let us imagine at the leading edge of a wing two particles of air. Let us suppose that one has to travel along the upper camber of the profile, while the second must follow the under camber; since the air cannot break, the upper particle will be forced to travel with a speed higher than that of the lower one. But it is a known fact in hydrodynamics that whenever the speed is high the pressure is low, and, therefore, the pressure on the upper side of the wing is much lower than on the under side. As a result of this difference of pressure there is a force acting on the wing as long as there is a relative motion of the wing and the air. This explains why an airplane must be in constant motion, and shows the importance of what is called the loss of speed.

The wing theory constitutes a very important branch of aerodynamics, and, today, besides the Kutta-Joukowsky theory, we have further developments of this question. It is possible at present not only to evaluate very accurately the characteristics of a given airfoil, but also to design airfoils with desired characteristics. The experimental research carried out in various wind tunnels of the world has enriched our technical library with records on numerous and varied airfoils, and in designing a new airplane it is customary to use these records instead of attempting to design a new airfoil. Only in special cases, as in high-speed racing planes, where every bit of refinement is required for a successful design, does a manufacturing company go to the expense of designing and experimenting with new airfoils.

The evolution in airfoils so far was as follows: the first machine did not have airfoils, properly speaking, but used flat and arched surfaces. The next step was toward thin airfoils, which seemed to be efficient. With the aid of wind tunnel research, and mathematical investigations, it was found that semi-thick and thick airfoils compare very favorably with the thin ones. In an orthodox design of today, almost invariably use is made of semi-thick airfoils, ranging in thickness from eight to twelve per cent of the chord. Planes of the future are pictured today by engineers as huge monoplanes with thick wing (20–25 per cent of the chord) housing motors, crew, passengers, etc., entirely within it.

The monoplane versus biplane is a highly debated subject, and each arrangement has its advocates. In my opinion, however, no fixed solution is possible, as it is merely a matter of conditions and service requirements that should govern an unprejudiced choice of the wing arrangement. Strength of the design is a criterion which often limits and directs the type of design.

One of the important features of airfoils is the variation of the lifting force, with change of the attitude of the airfoil in reference to the direction of flight. When the chord of airfoil makes a small angle with the relative wind, the lifting force and drag are small, and with increase of angle are gradually increasing; at an angle of attack of about fourteen to eighteen degrees there is a sudden drop in lifting force, and this point determines the landing speed of the craft. Since it is evident that the lower the landing speed the safer it is to fly an airplane, the efforts of engineers and inventors were long directed to increase the lifting power of airfoils, without appre-

ciably affecting the characteristics of profile at small angles of attack which govern the high speed of the craft.

There were various ingenious devices tried out, but the most promising one seems to be what is known as a slotted wing in combination with a flap. A slotted wing represents an airfoil built of one or more smaller airfoil—like portions which when closed form one large airfoil. By opening them the lifting power of the original airfoil can be increased considerably, thus decreasing the landing speed of the airplane.

The flap is a movable portion of the wing located at the trailing edge, which when lowered increases the maximum lift coefficient of the original profile. Since these devices result in mechanical complications, it was found that a single slot in combination with a flap is mechanically the most practical arrangement.

Planes having this arrangement are being tested out in England and Germany, in which two countries the idea of a slotted wing was first originated. It seems that the improvement of the planes in the immediate future lies in the perfection of the slotted wing.

STABILIZING AND CONTROLLING SURFACES

The stalling speed is a danger point of an airplane's flight because should this point be passed the plane will lose its flying speed with a resulting loss in lifting ability and control. Consequently the plane must be designed in such a way that when the angle of attack is being increased the airplane should have an inherent tendency to lower its nose (diving moment) and vice versa; a decrease in angle of attack should result in a tendency to raise the nose (stalling moment), thus preventing a dive.

A wing by itself, like every other streamlined body, does not follow this law. It has an unstable tendency to continue on whatever motion begun until a disastrous end. In order to counteract this tendency an airplane is fitted with an auxiliary wing, located at the rear of the body, for the purpose of stabilizing the craft. A flap action is utilized in this auxiliary surface to control the plane, and the movable portion is called the elevator, the whole combination being called the horizontal tail.

The horizontal tail is either supported by the rear end of the fuselage or is erected on special booms. Control is achieved by means of cables attached to controlling horns fastened to the surfaces. The cables lead to the pilot's control which is either a stick or wheel type.

The function of the horizontal tail is to assure longitudinal stability and control of the airplane. There are two other kinds of possible deviations of the craft during flight, namely the directional (yawing), and rolling. Directional stability is achieved by means of vertical surfaces, the rear part of which is movable, similar to the elevators. This part is called the rudder and is used to steer the craft right and left, just as in a motor boat.

The rolling or rotation of the plane about its longitudinal axis is corrected by means of increasing the lift on one side of the wing and decreasing it on the opposite side. The standard arrangement used for this purpose at present is to have on each side of the wing a flap (the aileron), extending only a part of the semi-span and connected to the pilot's control in such a manner that when one side is depressed the opposite is raised.

All these surfaces secure the control of the plane in the air, and their arrangement and sizes must be ample but not excessive.

Wind tunnel research plays a very important part in securing reliable information on flying properties of the craft. With the theoretical methods available at present, an engineer is able to investigate and design an airplane so that a desired degree of stability and controllability is secured.

The tail surfaces, in the early days, were flat surfaces located sometimes as at present behind the main areas, sometimes in front (the so-called Canard type). With the recognition of useful properties of airfoils the use of cambered sections in tail surfaces is practically standardized.

The adoption of the airfoil section is very important because it increased the range and power of control. With the accumulation of theoretical investigations and wind tunnel experiments, it becomes apparent that the old locations and sizes of stabilizing and controlling surfaces are almost invariably too large, and the new designs already show a closer study of this problem. As a result the length of the body or booms are shortened, weight of the structure decreased, and a saving in cost effected.

The improvements in the profile of the tail surfaces was followed by the improvement in the types of balance. The purpose of balancing the controlling surfaces is to decrease the force required to operate the controls. In future giant planes the controls will probably be operated by servo-motors or auxiliary surfaces. The slotted wing arrangement also finds its utilization in controlling surfaces at the airplane.

POWER PLANT

The sustaintion of an airplane is secured by motion of the wings relative to the surrounding air. To achieve this it is necessary to overcome the drag of the wings and also the parasite resistance. Parasite resistance is called the total resistance offered by the body, landing gear, tail surfaces, etc., to the motion through the air.

The propeller creates the necessary thrust, and as long as the airplane is in the state of level unaccelerated motion the propeller thrust is equal to the total drag of the machine. The propeller can be compared to an ordinary screw, or to two airfoils mounted on a rotating shaft and following a circular path. The resulting force on each blade can be resolved into a force along the direction of the motion—the thrust—and another in the plane of rotation of the propeller—the torque. The torque movement of the propeller is equal to the torque of the engine obtainable on the crankshaft.

The propeller blades are shaped, taking into account the fact that each portion of the blade meets the airstream at different angles and at different speeds. Ordinary propellers are made of laminated wood, but recently developed metal propellers showed higher efficiency and good weatherproof qualities, and the metal propeller will unquestionably supplant the wooden one. There were invented propelling units of most varied nature, but if one thinks of the high efficiency obtainable with an ordinary propeller, it is almost certain that this simple device will be the winner for the range of present speeds. The efficiency of an ordinary propeller (for a comparatively slow airplane) is around eighty per cent, while the high-speed propellers have an efficiency of around eighty-five per cent.

The comparative inefficiency of the present power plant lies mainly with the engine which is a perfected type of four-cycle explosion motor, using gasoline as fuel. There are water and air-cooled types, but the general trend is noticeably toward the latter. This

fact is explained by the elimination of the water system (a frequent cause of trouble in a water-cooled engine), which saves in weight, and retains practically the same high speed of the airplane. The added reliability and decreased weight are very important factors, and as a result the air-cooled engines are rapidly gaining in favor among aeronautical engineers.

Low weight is a very important requirement of an airplane engine, and combined with requirements of simplicity and reliability an airplane engine of today is a remarkable achievement of engineering. Light alloys and high-grade steels are used exclusively in aviation engines of today.

The operation of airplanes at high altitudes results in the necessity of employing superchargers, which feed the engine with the air at sea-level pressure. The use of superchargers, with a comparatively small increase in first cost, results in an increased efficiency of operation, and even engines which are not specially built for high altitude work at present are equipped with superchargers.

The desire to improve the efficiency, and increase the power per weight, results in the research on two-cycle explosion and Diesel engines, and also in study of the possibilities of creating a gas turbine. The gas turbine will have an important advantage of smoothness of operation and uniformity of action. Jet propulsion (that is, the employ of reaction of escape of exploded gases directly, without use of propellers) is another feature studied by engineers, but it seems that the real advantages of such a power plant could be gained only at speeds much above the ones obtainable at the present time.

BODY

The body or fuselage houses pilots, crew, passengers and luggage. The airplanes of the early days did not have what at present is known as the body; the pilot simply sat on a small seat with landscape visible from beneath and on all sides. The old type of fuselage structure with its many struts, wires and fittings, the pilot himself exposed to the wind, represented considerable resistance and discomfort. The realization of this led to covering the fuselage with fabric. The enclosed fuselage has a lower resistance and also presents a comfortable housing space for the pilot.

Large commercial airliners of today have spacious, noiseless, well-ventilated, heated and comfortably furnished cabins. The pilots' compartment has steering mechanisms and instruments for flying and navigating. There are usually special luggage spaces and lavatories. In the case of a military plane, the body houses the machine guns, bombs, photographic cameras, etc., as the purpose of the craft may require.

Single-engined planes have the engine in the front part of the fuselage, and fuel stored as close as possible to the center of gravity of the airplane. Multimotored planes may have a central motor room in the fuselage, but preferably the motors are located on the wings with fuel and oil stored in special tanks, the whole unit streamlined to minimize the air resistance.

In a plane of such size that passengers could be housed inside of the wing, the fuselage will disappear and instead there will be booms or outriggers supporting the tail surfaces.

LANDING GEAR

Since an airplane cannot fly below a certain speed, in order to begin its flight a machine must gather this speed by running along the ground (or water, in the case of water craft). On the other hand, at the instant of contact

with the ground an airplane still has its flying speed, and before coming to a full stop it must have some means of rolling or sliding along the ground. For this purpose airplanes are equipped with landing gear or chassis, which, depending on the type of the craft, are either land or water types.

A land-type airplane, called a landplane, may be required to operate from the ground or snow, and in such cases is fitted with wheels or skis.

Wheel-type landing gears are of most varied design, but can be segregated into two distinct groups—axle and split-axle. The distinction of these two types lies in the presence of a continuous axle in the first group; while in the second the axle is bent up so that there is no continuous member joining the two wheels. The advantage claimed for this type is the reduction of hazard of nosing over, should the plane be forced to land in case of emergency on unsuited ground. It is also better because it minimizes the possibility of striking objects on the ground while taking off or alighting. Skis made out of wood or metal are used in operating from the snow-covered ground in northern countries.

Landing and running over the ground imposes a rather severe shock on the chassis, and in order not to transmit it into the structure, landing gears are equipped with shock-absorbing devices. The first and the lightest was shock-absorber cord in tension. At present there is a variety of shock-absorbing devices such as: rubber disks in compression, rubber balls and oleo, steel springs and oleo, etc. The most popular seems to be the oleo type operating on the principle of the hydraulic braking effect of special oil while passing through small orifices, a comparatively simple detail in a small airplane. When one thinks of giant airplanes of the future, the landing gear must present most intricate problems.

The water-type landing gear is of two types—single and twin float. In the first case there is a single float under the main body of the airplane, and the lateral stability of the craft at rest or at low speeds is obtained by means of auxiliary wing tip floats. The buoyancy of this float is sufficient to counteract, with a margin, the offsetting moment of the inclined craft. A twin float type does not require the presence of wing tip floats, because its two floats are located very similarly to the two wheels of a landplane.

This type of water craft is called seaplane. Besides this there is a third variety of water-operating airplanes which are called flying boats. As the name implies, these are especially built airplanes in which the body is built like a boat, so that it can take off and alight on water.

CONCLUSION

The few pages allotted to this article are hardly sufficient even for an extremely abbreviated description of the workings and principles of this modern achievement. The airplane is a glorification of engineering because it marks the conquest over the most extensive and one of the most powerful elements —the air.

If economy is a purpose in other branches of engineering, it is a necessity in aeronautics. The exacting requirements of aeronautical engineering are already felt throughout the technical world; better material, lighter material, saving in sizes, closer and better standards. This effect is also felt morally. The intricate problems of design require a thorough knowledge in different branches of engineering, and as a result it leads to a higher standard of engineering education.

The usual antagonism of science and

practice is disappearing in aeronautics because of closer scrutiny of materials, and high standards of workmanship made it possible to prove to most practical men that "figures don't lie."

The airplane of today is a reliable means of transportation which may be used without hesitation. The heroic period has passed, and daring and trying is supplanted by accurate engineering calculations and methodical research.

The First Flight

By Jessie E. Horsfall
Editor, *Aero Digest*

THE flights of their glider in 1902 convinced Wilbur and Orville Wright of the efficiency of their system of maintaining equilibrium, and the accuracy of the laboratory work upon which the design of their glider was based. They then felt they were prepared to calculate in advance the performance of machines with a degree of accuracy that had never been possible with the data and tables used by their predecessors. Before leaving their camp at Kitty Hawk, North Carolina, in 1902, they were at work on the general design of a new machine which they proposed to operate with engine-driven propellers.

The First Engine

Upon their return to Dayton they wrote to a number of automobile and engine builders, stating the purpose for which they desired an engine, and asking whether one could be furnished that would develop eight-brake horsepower, with a weight complete not exceeding 200 pounds. Most of the companies answered that they were too busy with their regular business to undertake the building of such an engine, but one company replied that they had engines which weighed only 135 pounds and rated at 8 h. p., according to the French system of ratings. It had but a single cylinder of four-inch bore and five-inch stroke, and its power probably was much overrated. Unless it would develop a full eight-brake horsepower it would not serve its purpose.

Finally the Wright brothers decided to build an engine themselves. They designed an engine of four cylinders with four-inch bore and stroke, weighing not over 200 pounds including all accessories. Up to that time their only experience in the building of gasoline engines had been in the construction of an air-cooled engine, five-inch bore and seven-inch stroke, used to run the machinery of their small workshop. To be certain that four cylinders of the size they had decided upon would develop the necessary 8 h. p., they first fitted them into a temporary frame of simple and cheap construction. Six weeks from the time the design was started they had the engine on the block, testing its power. There was no provision for lubricating either cylinders or bearings while this engine was running, and for that reason it was not possible to run it more than a minute or two at a time. In these short tests the engine developed about 9 h. p. They were then satisfied that with proper lubrication and better adjustments a little more power could be expected. The completion of the engine was therefore proceeded with at once.

Designing the Machine

While their assistant, Mr. C. E. Taylor, was engaged with this work, the Wright brothers were completing the design of the machine itself. The preliminary tests of the engine having indicated that more than 8 h. p. would be secured, they felt free to add enough weight to build a more substantial machine than originally contemplated.

Their tables of air pressures and experience in flying with the 1902 glider

enabled them to calculate the thrust necessary to sustain the machine in flight. But to design a propeller that would give this thrust, with the power at their command, was a matter not as yet seriously considered. Data on air propellers were not available, but they understood that an efficiency of fifty per cent with marine propellers was not unusual and that it would be necessary only to learn the theory of the operation of marine propellers from books on marine engineering, substituting air pressures for water pressures. Several such books were secured from the Dayton Public Library. All the formulae on propellers contained in these books were of an empirical nature, and there was no way of adapting them to calculations of aerial propellers. As they could neither afford the time nor expense of a long series of experiments to find by trial a propeller suitable for their machine, they decided to rely more on theory than was the practice of marine engineers.

They agreed that a propeller was simply an aeroplane traveling in a spiral course. As they could calculate the effect of an aeroplane traveling in a straight course, they felt that to calculate the effect of one traveling in a spiral course would not be difficult.

On further consideration they found it hard to find even a point from which to make a start, for nothing about a propeller, or the medium in which it acts, stands still for a moment. The thrust depends upon the speed and the angle at which the blade strikes the air; the angle at which the blade strikes the air depends upon the speed at which the propeller is turning, the speed the machine is traveling forward, and the speed at which the air is slipping backward; the slip of the air backward depends upon the thrust exerted by the propeller and the amount of air acted upon. When any one of these changes it alters all the rest, as they are all interdependent. But these are only a few of the many factors that must be considered and determined in calculating and designing propellers. Their minds became so obsessed with it that they could do little other work. They engaged in innumerable discussions, and often after an hour or so of heated argument would discover that they were as far from agreement as when they started, but that both had changed to the other's original position in the discussion. After several months of this study and discussion they were able to follow the various reactions in their intricate relations long enough to begin to understand them. They realized that the thrust, generated by a propeller when not moving through the air, was no indication of the thrust when moving forward. Their only recourse to really test the efficiency of propellers would be to actually try them on the machine.

For two reasons they decided to use two propellers. In the first place by the use of two propellers they could secure a reaction against a greater quantity of air, and at the same time use a larger pitch angle than was possible with one propeller; and in the second place by having the propellers turn in opposite directions the gyroscopic action and torque of one would neutralize that of the other. The method adopted, of driving the propellers in opposite directions by means of chains, is now too well known to need description here. They placed the engine to one side of the pilot so in case of a plunge headfirst, the engine could not fall upon him. In their gliding experiments they had had a number of experiences in which they had landed upon one wing, but the crushing of the wing had absorbed the shock, so that they were not uneasy

about the motor in case of a landing of that kind. To provide against the machine rolling over forward in landing, they designed skids like sled runners, extending out in front of the main surfaces. Otherwise the general construction and operation of the machine was to be similar to that of the 1902 glider.

When the engine was completed and tested, they found that it would develop 16 h. p. for a few seconds, but that the power rapidly dropped until, at the end of a minute, it was only 12 h. p. Ignorant of what a motor of this size ought to develop, they were greatly pleased with its performance. With 12 h. p. at their command, they considered that they could permit the weight of the machine with operator to rise 750 to 800 pounds and still have as much surplus power as they had originally allowed for in the first estimate of 550 pounds.

Before leaving for their camp at Kitty Hawk they tested the chain drive for the propellers in their shop at Dayton and found it satisfactory. They found, however, that their first propeller shafts, which were constructed of heavy gauge steel tubing, were not strong enough to stand the shocks received from a gasoline engine with a light fly wheel, although they would have been able to transmit three or four times the power uniformly applied. They therefore built a new set of shafts of heavier tubing, which were tested and thought to be strong enough.

They left Dayton, September 23, arriving at the camp at Kill Devil Hill on Friday, the 25th. Provisions and tools had been shipped by freight several weeks in advance. The building, erected in 1901 and enlarged in 1902, was found to have been blown by a storm from its foundation posts a few months previously. While they were awaiting the arrival of the shipment of machinery and parts from Dayton, they put the old building in repair and erected a new building to serve as a workshop for assembling and housing a new machine.

Just as the building was being completed, the parts and material for the machine arrived. The next three weeks were spent in setting the motor machine together. On days with more favorable winds they gained additional experience in handling a flyer by gliding with the 1902 machine.

MATHEMATICAL BASES

While Mr. Chanute was with them a great deal of time was spent in discussion of the mathematical calculations upon which the Wrights had based their machine. Mr. Chanute informed them that, in designing machinery, twenty per cent was usually allowed for the loss in the transmission of power. As they had allowed only five per cent, a figure arrived at by some crude measurements of the friction of one of the chains when carrying only a very light load, they were much alarmed. More than the whole surplus in power allowed in their calculations would, according to Mr. Chanute's estimate, be consumed in friction in the driving chains. After Mr. Chanute's departure, they suspended one of the drive chains over a sprocket, and on it fixed a weight approximately equal to the pull that would be exerted on the chains when driving the propellers. By measuring the extra amount of weight needed on one side to lift the weight on the other they calculated the loss in transmission. This indicated that the loss of power from this source would be only five per cent, as originally estimated. But while they could see no serious error in this method of determining the loss, they were uneasy until they had a chance to run the

propellers with the engine to see whether they could get the estimated number of turns.

TESTS AND DIFFICULTIES

The first run of the motor on the machine developed a flaw in one of the propeller shafts. The shafts were sent at once to Dayton for repair, and were not received again until November 20. They put them in the machine and made another test. A new trouble developed. The sprockets, which were screwed on the shafts and locked with nuts of opposite thread, persisted in coming loose. They heated the shafts and sprockets, melted hard tire cement into the threads and screwed them together again. This trouble was over. The sprockets stayed fast.

Just as the machine was ready for test, bad weather set in. It had been disagreeably cold for several weeks, so cold that some days they could scarcely work on the machine. But it now began to rain and snow, and from the north a wind of 25 to 30 miles blew for several days. While they were being delayed by the weather, they arranged a mechanism to measure the duration of flight from the time the machine started to move forward, to the time it stopped; the distance traveled through the air in that time; and the number of revolutions made by the propellers. The watch, anemometer, and revolution counter were all automatically started and stopped simultaneously. From data thus obtained they expected to prove or disprove the accuracy of their propeller calculations.

On November 28, while giving the motor a run indoors, one of the tubular shafts cracked! Solid tool-steel shafts of smaller diameter than the tubes previously used were decided upon. They would allow a certain amount of spring. The tubular shafts were many times stronger than would have been necessary to transmit the power of the motor if the strains upon them had been uniform. But the large hollow shafts had no spring in them to absorb the unequal strains.

Wilbur remained in camp while Orville went to get the new shafts. Orville did not get back to camp again till Friday, the 11th of December. Saturday afternoon the machine was again ready for trial, but the wind was so light that a start could not have been made from level ground with the run of only 60 feet permitted by their monorail track; nor was there enough time before dark to take the machine to one of the hills, where, by placing the track on a steep incline, sufficient speed could be secured for starting in calm air.

Monday, December 14, was a beautiful day, but there was not enough wind to enable a start to be made from the level ground about camp. They therefore decided to attempt a flight from the side of the Kill Devil Hill. Having arranged with the members of the Kill Devil Life Saving Station, located a little over a mile from camp, to inform them when the first trial of the machine was ready to be made, they were soon joined by J. T. Daniels, Robert Westcott, Thomas Beachem, W. S. Dough, and Uncle Benny O'Neal, of the station, who helped get the machine to the Hill, a quarter mile away. A track was laid 150 feet up the side of the hill on a nine-degree slope. With the slope of the track, the thrust of the propellers, and the machine starting directly into the wind, they did not anticipate any trouble in getting up flying speed on the 60-foot monorail track. But they did not feel certain the operator could keep the machine balanced on the track.

THE FIRST TRIAL

When the machine had been fastened with a wire to the track so that it could not start until released by the operator, and the engine had been run to make sure it was in condition, the brothers tossed up a coin to see who would make the first trial. Wilbur won. Orville took a position at one of the wings, intending to help balance the machine as it ran down the track. When the restraining wire was slipped the machine started off so quickly he could stay with it only a few feet. After a 35- to 40-foot run, it lifted from the rail. But it was allowed to turn up too much. It climbed a few feet, stalled, and then settled to the ground near the foot of the hill, 105 feet below. The stop watch showed that it had been in the air just three and one-half seconds. In landing the left wing touched first. The machine swung around, dug the skids into the sand and broke one of them. Several other parts were also broken, but the damage to the machine was not serious. The test had shown nothing as to whether the power of the motor was sufficient to keep the machine up, since the landing was made many feet below the starting point, but the experiment showed that the method adopted for launching the machine was a practical one. On the whole they were much pleased.

Two days were consumed in making repairs, and the machine was not ready again till late in the afternoon of the 16th. During the night a strong cold wind blew from the north. When they arose on the morning of the 17th the puddles of water, which had been standing about camp since the recent rains, were covered with ice. The wind had a velocity of 22 to 27 miles an hour. They thought it would die down before long, and so remained indoors the early part of the morning. But when 10 o'clock arrived and the wind was as brisk as ever, they decided they had better get the machine out and attempt a flight. They hung out the signal for the men of the Life Saving Station. They thought that by facing the flyer into a strong wind, there ought to be no trouble in launching it from the level ground about camp. They realized the difficulties in flying in so high a wind, but estimated the added dangers in flight would be partly compensated for by the slower speed in landing.

THE SECOND ATTEMPT

A track was laid on a smooth stretch of ground about 100 feet north of the new building. The biting cold wind made work difficult, and they had to warm up frequently in their living room, where there was a good fire in an improvised stove made of a large carbide can. By the time all was ready, J. T. Daniels, W. S. Dough and A. D. Etheridge, members of the Kill Devil Life Saving Station, W. C. Brinkley of Matero, and Johnny Moore, a boy from Nags Head, had arrived.

They had a hand anemometer with which they measured the velocity of the wind. Measurements made just before the first flight showed velocities of 24 to 27 miles per hour. The records of the Government Weather Bureau at Kitty Hawk gave the velocity of wind between the hours of 10.30 and 12 o'clock, the time during which the four flights were made, as averaging 27 miles at the time of the first flight and 24 miles at the time of the last.

Wilbur, having used his turn in the unsuccessful attempt on the 14th, the right to the next trial now belonged to Orville. After running the engine a few minutes, to heat it up, he released

the wire that held the machine to the track, and the machine started forward into the wind. Wilbur ran at the side of the machine, holding the wing to balance it on the track. Unlike the start on the 14th, made in a calm, the machine now facing a 27-mile wind started very slowly. Wilbur was able to stay with it until it lifted from the track after a 40-foot run. One of the life-saving men snapped the camera for them, taking a picture just as the machine had reached the end of the track and had risen to a height of about one foot. The slow, forward speed of the machine is clearly shown by Wilbur's attitude. He stayed along beside the machine without any effort.

The course of the flight up and down was exceedingly erratic, partly due to the irregularity of the air, and partly to lack of experience in handling this machine. The control of the front elevator was difficult on account of its being balanced too near the center. This gave it a tendency to turn itself when started, so that it turned too far on one side, and then too far on the other. As a result the machine would rise suddenly to about 10 feet, and then as suddenly dart for the ground. A sudden dart when a little over a hundred feet from the end of the track, or a little over 120 feet from the point at which it rose into the air, ended the flight. As the velocity of wind was over 35 feet per second and the speed of the machine over the ground against this wind 10 feet per second, the speed of the machine relative to the air was over 45 feet per second, and the length of the flight was equivalent to a flight of 540 feet made in calm air. This flight lasted only twelve seconds but it was, nevertheless, the first in the history of the world in which a machine, carrying a man, had raised itself by its own power into the air in full flight, had sailed forward without reduction of speed, and had finally landed at a point as high as that from which it started.

Aeronautical Education

By Alexander Klemin

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THE pioneers of the early days of aviation were men of original and adventurous mind, who owed little to formal education of university character. The Wright brothers themselves, while well-educated men, who conducted their first experiments in a most systematic and scientific manner, certainly did not owe their inspiration to the professors of a university or a technical school. In fact official science was inclined to scoff at the possibility of heavier-than-air flight. All the greater credit is due to Langley for his pioneer work, since he certainly belonged to the ranks of "official scientists." But when once the radical departure from accepted ideas had been made, and two men of genius had flown at Kitty Hawk, scientific experimentation did not fail to step in. In fact it may safely be said that in the development of no other branch of engineering has scientific work been so intensive or so rapid as in aeronautics. Particularly under the impetus of the World War, many laboratories set to work strenuously to develop the science of aerodynamics, to refine the structure of aircraft, and to investigate a dozen closely allied fields. While government laboratories both in Europe and the United States bore the brunt of the experimental work insofar as it related to improved construction, the universities played their share in the development of the more general ideas. The remarkable work of Göttingen University, in the development of the vortex theory, may be cited as a brilliant example. The universities also recognized at an early date that systematic instruction in aeronautics was one of their proper functions.

Thus even before the great war there were centers of instruction and research as at Göttingen in Germany, at the Petrograd Institute of Technology in Russia, at the University of Paris in France.

University Training

It may be interesting to outline briefly what the university has to do in the education of the aerodynamicist and the aeronautical engineer, and of the future industrial operator of aircraft.

First it must give him the fundamentals of physics, mathematics, mechanics, and general engineering which must serve as the granite base for all specialized superstructure. In mathematics and mechanics, the basic knowledge required is considerably greater than in other branches of engineering. The design of aircraft is in part a matter of artistic feeling, inspiration, or what you will. But it is also a matter of analysis and calculation. The construction of a machine tool is based on certain mechanical instincts well implanted in the mind of man. The dynamics and stability of an aircraft in its evolutions in three dimensions is more a matter of careful analysis, in which mathematics must help.

Science of Aerodynamics

The basic science is, of course, aerodynamics, the science of air flow and forces. Here the university or technical school must provide the student with practice in the wind tunnel. This is a huge Venturi, at the throat of which small models are placed; on these a stream of air impinges, produced by the

blast of a large propeller. By an elementary concept of relativity, the forces on a body past which air flows at a certain velocity, are the same as if the body were moved at the same velocity through stationary air. Therefore if the forces on the stationary model are accurately measured, prediction is possible of the forces which will be present on the full sized airplane. Hence the stability and safety of the airplane may be studied. The tunnel may also be made to give a measure of the efficiency of the craft, the ratio of the sustaining force to the retarding force which the energy of the propeller has to overcome. No student is competent to understand aerodynamics, until he has himself performed certain basic experiments in the wind tunnel.

STRUCTURE OF AIRCRAFT

The structure of aircraft is another important item in the student's training. The airplane must be not only strong, but light, differing in this respect from many other forms of structure, where strength is essential but weight is a comparatively secondary consideration. The student analyzes carefully the stresses and strains which come on aircraft by refined methods, which at the moment lead structural theory in every field. Then he supplements his theory by tests to destruction of various component parts such as wing ribs, struts, wires, and even whole groups of the airplane, such as the tail surfaces or fuselage.

The aircraft power plant is studied carefully, but here the work is analogous to the general study of the internal combustion engine and presents few novelties in method.

We shall not go into further detail with regard to other branches of instruction. While the subject matter of the teaching is constantly changing—progress in the art is so rapid, that textbooks are out of date as soon as published and the work of the instructors is greatly increased thereby—the general syllabus of instruction in aeronautical engineering has been in a measure standardized, and the syllabuses of the great American schools of aeronautics have all a close family resemblance. They include specifically, aerodynamics theoretical and experimental, theory of airplane design, practical airplane design, airship theory, airship design, propeller theory and design, aircraft engine theory and design, structural analysis, and similar topics. In the various schools more emphasis is placed on different topics, but the general method of approach never varies greatly.

The courses in aeronautics are generally given as the fourth year of a student's general course in mechanical engineering as at New York University, in naval architecture as at Michigan, as purely graduate work as in some of the western universities, or in both undergraduate and graduate years as at New York University and Massachusetts Institute of Technology. It is inconceivable that aeronautical engineering should ever be taught as a course in itself. It should always follow a solid education in general engineering. It is one of the difficulties of an instructor that he must frequently interview young men who wish to be aeronautical engineers but call for immediate specialization without going through the basic and essential training.

RECOMMENDATIONS

The writer of this short article believes that university instruction, even in engineering, should not strive to be ultra-practical. In the career of the average engineer, the university is apt to be the one stage where he really digs into fundamental principles. His practical experience will teach him quickly

enough, but in very few factories will he have time to absorb principles. But while the university may rightly stress principles, there is no reason why the generous summer vacations should not be utilized for the practical work. Students should if possible learn to fly. The Air Units of the Army, and the Naval Air Service Reserve furnish excellent opportunities in this regard. Or they may enter the shops of a constructor, working as a mechanic's helper at an average wage of fifty cents an hour. The writer makes every endeavor in his personal contacts with students to encourage them in securing such summer work, and he is confident that his colleagues in other schools adopt a similar attitude. At New York University, the coöperative course, in which the student spends eight months in practical work and then an alternate eight months at college, has been developed into a highly successful system.

Flying and practical experience with aircraft operators, as distinct from aircraft constructors, is particularly valuable to those young men who wish to pursue one of many phases of industrial operation, such as air transport, aerial photography, etc.

Air transport in particular may offer great opportunities to the college graduate. To meet the needs of the future air transport operator, the syllabuses of instruction are being supplemented with courses in the design of airways and airports, in the analysis of operational costs, in the study of such important aids to navigation as aircraft radio and aircraft lighting.

GRANTS TO AERONAUTICAL EDUCATION

Aeronautical education in the United States has lately received a tremendous impetus by the efforts of two men, Mr. Daniel Guggenheim and his son, Mr. Harry F. Guggenheim. It is the good fortune of American universities that they can at psychological moments, and when their needs are really justified, count on the generosity and farsightedness of our great business leaders. Certainly the work of these two men in the field of aeronautical education has been of incalculable value. In the summer of 1925, after very careful investigation by Harry Guggenheim, Mr. Daniel Guggenheim established a school of aeronautics at New York University with a fund of $500,000. This was followed shortly afterward by the establishment of the Daniel Guggenheim Fund for the Promotion of Aeronautics, with provision for the supply of $2,500,000 when needed. Harry Guggenheim was elected the President of this Fund, Admiral H. I. Cone, the Vice-President, with a board of distinguished trustees. The Fund directed its energies from the very first towards education. The following grants to education have been made thus far: to Leland Stanford University in California, a fund amounting to the income on $300,000 for the financing of experiments and study in aviation and aeronautics; to the California Institute of Technology, $300,000 for the erection of a permanent building for the study of aeronautics and for experimentation; to the University of Michigan, $78,000 has been granted for the completion of laboratories and extension of instruction; to the Massachusetts Institute of Technology, $225,000 for the construction of a permanent building.

The effort has thus been wise, generous, and nationwide in scope. It will not be for lack of generous support if the universities of the United States fail to secure the foremost position in aeronautical science and education.

Learning to Fly

By Casey Jones
Curtiss Flying Service, Inc.

"I HAVE just soloed." What pleasant memories this expression brings to thousands of pilots, significant of the greatest event in their flying career—the day when they first flew alone. Like the baby's first step, the boy's first whistle, the first money earned, this flight stands out as a real achievement—a milestone along the road to the accomplishment of a new art. Here is a romantic appeal, interesting to any red-blooded young man, but particularly to those of the coming generation who today, as a matter of course, know more about aviation than their elders.

There is no question but that in the near future the air will become one of the greatest, if not the greatest, of transportation mediums. What facts have we on which to base such a prediction? Many! In Europe today air commerce is exceedingly common, and it is possible to travel between all the principal European cities in as much comfort and safety, at very little more expense and far more quickly, than by train or boat. True, these lines are not paying at present, and are possible only because of government subsidy. Increased efficiency in planes and motors, coupled with increased volume of business, will unquestionably remedy this condition. During the past year the United States Post Office Department has contracted with more than ten reliable companies, whose stockholders are hard-headed business men, for the transportation of mail by air. After six months of operation, several of these lines are actually paying dividends, something unheard of in so short a period in the pioneering of any previous means of transportation. The bulk of the mail in the United States will soon be carried by air—express and passengers will follow. So, apart from the romantic side, it is well for a young man to investigate the possibilities of aeronautics as a life work.

There are many branches to the aeroplane business, such as manufacturing, engineering, operating and selling, but space in this article will not permit a discussion of their various possibilities. However, to successfully engage in any of them it is desirable, even necessary, to know how to fly.

Preliminary Training

Training methods, due to the experience gained by training hundreds of pilots during the war, have become fairly well standarized throughout the world. This standardization has practically eliminated the hazard that was formerly associated with flying training. So today, with proper equipment, operating facilities, and competent personnel, the casualties sustained in preliminary training are negligible. The school operated by the Curtiss Flying Service, Inc., at Garden City, N. Y., has, alone, soloed something over five hundred students since 1919 without accident or injury to instructor or student, and many other schools throughout the country have records equally good. The most dangerous period for the embryo pilot is after he has spent twenty-five to fifty hours in the air by himself, and begins to consider that he is a first-class pilot, capable of taking unusual chances. It is

then that he should be especially careful, or he will soon find that it does not pay to take too many liberties with Old Man Gravity.

The usual procedure of instruction is somewhat as follows: An instructor shows the student, or a group of students, the working of the controls, rudder, wings, etc., explaining why and how they operate. After this explanation the student is required to demonstrate to the instructor, on the ground, that he understands it. They then take off with the instructor at the controls in the front cockpit, and after arriving at an altitude sufficient to give the instructor time to get the ship out of any position in which the student may place it, the controls are turned over to the student, who endeavors to follow instructions given him on the ground. There is a duplicate set of controls in each cockpit, so that the instructor at all times can regain control of the plane. The greatest danger is that the student may become overexcited and freeze the controls. Students are particularly warned against this from the time they enter a flying school. Perhaps the most remarkable thing about flying is its ease of accomplishment, for all controls work naturally. For instance, if it is desired to descend the control stick is pushed forward, to ascend it is pulled back, to bank to the right the stick goes to the right, etc., and within thirty to sixty minutes in the air the average student can keep the plane on even keel and even do gentle turns. As soon as these are learned he is started on landings and take-offs which are by far the most difficult things for the beginner, requiring, as they do, coördination of mind and body, coupled with a close judgment of speed and distance. Even these become easy with practice, and in five or six hours the average student is ready to solo. During this period pilots and students are in communication either by manual signs or by the use of telephonic helmets. After the solo flight the student continues to practice with the instructor, taking preliminary advanced instruction in various maneuvers including spirals, loops, spins, etc. This is about the extent of the training offered in the average ten-hour commercial school course, and will enable a pilot to fly safely alone provided he remembers what he has learned, is careful not to take unnecessary chances, and uses his head at all times. As one instructor aptly expressed it, "We can teach anyone to fly, but we cannot make him think."

LONG EXPERIENCE ALONE MAKES FOR SKILL

It will be noted that I was careful to state that ten hours was usually sufficient for the average student to fly safely *alone*, but this by no means infers that he is a skilled pilot ready for commercial work. It is a matter of minutes to learn how to drive a car—shift gears, steer, apply brakes, etc., but the ability to do these things does not necessarily make a competent driver. It requires continued driving so that these details become automatic. The same principle applies to flying, long experience in the air alone so that it becomes second nature. The Department of Commerce air regulations now require one hundred hours solo flying before a license is granted to carry passengers. Reliable concerns have long required at least this amount of time before employing a pilot. This brings us face to face with one of the most serious problems confronting aviation today. How can we make it economically possible for the average man to get sufficient flying to enable him to earn his living as a pilot? To the casual observer this problem may

seem of little importance, and perhaps it would be if it applied only to commerical aviation, but in reality it has a direct bearing on our national defense.

SCARCITY OF TRAINED PILOTS

The Air Corps of the Army operates a very excellent flying school in Texas, giving a ten months' course with some 150 hours of flying. This course is so stiff that only a small percentage of the entrants graduate. In fact, whether or not this course is too severe is a matter of dispute in Air Corps circles. At any rate, the number of graduates is not even sufficient to take care of the increased quota of officers provided for under the new Army Air Plan, and will not be for the next five years. This means that no new pilots are being trained for the Air Corps Reserve, which is our second line of defense. Our present Reserve is composed of flyers who were trained, for the most part, during the war. Within a very few years these men will be too old to be of any real value in time of war, for aviation is unquestionably a young man's game. Therefore, the only place we can look for Reserve material is among the young men trained commercially, and consequently the problem is really one of great importance. If we get no new blood in our Air Reserve we will be in a serious position in time of war.

Unless some comprehensive plan is worked out to meet the situation there will be a marked decrease in the number of new pilots. Remember, only since January 1, 1927, has a license actually been required by law, and many who have taken up aviation since 1919 have done so, because they could start earning money immediately by operating their own planes commercially, whether they could fly or not. This is now prohibited, and wisely!

A WAY OUT

Let us take stock of what has been or can be done. A few men yearly take up aviation for pleasure, own and operate their own planes, and in time become real pilots. This requires so much capital that the vast number of young men, who would make the very best of pilots, are shut out. The Curtiss Flying Service, Inc., has developed an excellent plan of engaging such men at very small salaries as mechanics, teaching them to fly, and allowing them to continue flying over a period of years in partial payment for their mechanical services. In time these men become first-class pilots, but again the number trained by this method is very limited. Today these two classes, plus the government-trained pilots mentioned earlier, are our only sources of supply, and are pitifully inadequate to meet the needs of a growing industry and our national defense.

A plan has been presented to the War Department which is receiving the study of the various heads and which apparently has considerable merit. The general idea is for commercial schools to sell sufficient flying training to qualify a student for a Reserve pilot's rating in the Air Corps Reserve. This can be done without unreasonable expense to the applicant. He is then commissioned in the Reserve, after passing the necessary mental, physical, and flying tests, and is permitted to fly Air Corps planes for a certain number of hours per month, at the expense of the government. In return he is subject to the call of the government in the time of emergency. In a year or so, under this system, the pilot would receive sufficient time to qualify him for a commercial position. He can support himself by other means during this period, and except for his preliminary instruction it costs him noth-

ing but his responsibility to the government. The War Department objects to the plan because of the absence of proper military training which commercial schools cannot supply. The Department, however, is considering the possibility of creating a new rating to include pilots, without granting commissions, and allowing them to fly, and giving them their commissions when they have acquired sufficient military knowledge which is to be furnished by the government. This would be a long step in the right direction. The Department has already approved of the plan as applied to applicants with the necessary military qualifications obtained through former service, R. O. T. C., etc.

Some similar system applied to the Navy training and National Guard would go far to solve the immediate problem. Aeronautical associations, aero clubs, and organizations, such as the Guggenheim Foundation, should be able to initiate workable plans for training others. In fact, as the aeronautical brains of the country are applied to the problem countless other solutions will present themselves.

The condition of the aviation industry in general is healthy. The five-year Army and Navy programs insure manufacturers of a reasonable continuity of orders; Post Office contracts for Air Mail lines and increasing commercial demands for the aeroplane are encouraging commercial operators; sane legislation by Congress, and a more comprehensive understanding of aviation by the press and public are aiding the good work. The outlook is promising.

To You, young man of pioneering spirit, ambitious for your future, and possessing a willingness for hard work, aviation offers unlimited opportunities. Learn to fly, and some day, above all material reward the future holds, will come that satisfaction that only those can know who, in the accomplishment of this new art, have said "I have just soloed."

Aircraft Engineering

By T. P. Wright, B.S.
Chief Engineer, Airplane Division, Curtiss Aeroplane and Motor Co. Inc.

BY aircraft is meant any weight-carrying device or structure designed to be supported by the air. There are two classes of aircraft, heavier-than-air and lighter-than-air, the former obtaining its lift from dynamic air pressure, the latter from buoyancy due to displacement of air by a lighter gas. The present article will deal entirely with heavier-than-aircraft or airplanes.

General Considerations and Definitions

It seems desirable, before describing the engineering methods used in designing an airplane today, to review briefly the stages of development of aviation, noting particularly the engineering progress made during each stage. In order to fix clearly in mind the status of the development during each period discussed, it is well to consider the meaning of such general terms as "art," "science," and "engineering." Whereas mechanical art implies a practical application of knowledge, science refers to an exact and systematic statement of knowledge. Art always relates to something to be done, science to something to be known. In engineering is included the basic idea of executing or managing a construction or design. It will be seen that at a relatively early date a considerable amount of scientific information pertaining to aviation was brought together, and that experiments were conducted, some by scientific and some by rule-of-thumb methods. It has not been, however, until very recently, that engineering methods have been applied uniformly to airplane design and construction. This of course is true of the development of any art, as a considerable period of research and of attainment of practical experience is necessary before the systematic methods of an engineering organization can be applied.

Stages of Development

The stages of development of aviation may be conveniently grouped into three periods, namely, the period before the war, the period during and immediately following the war, and the period thereafter.

There seem to be two distinct subdivisions of the stage of development prior to the war, the first commencing about 1890 and lasting until 1903, and the second extending from 1903 to 1914. During the earlier period there were at work two quite distinct types of men. One type is represented by Professor Langley seeking knowledge of aerodynamics by truly scientific methods of research. By means of a whirling arm, Professor Langley obtained and measured the aerodynamic forces on flat plates mounted at the end of the arm. From data thus obtained, an airplane was designed and constructed, which succeeded in lifting its own weight. Unfortunate circumstances not pertaining directly to the airplane, apparently prevented him from seeing his machine with power carry a man into the air. There was another type of investigator at work during this period represented by Lillienthal in Germany, and Chanute and the Wright Brothers in this Country. The efforts of these men were

directed to gliders. Great numbers of gliding flights were made, usually culminating in a disaster. These accidents were due principally to dependence for lateral control on the slight effect of shifting the center of gravity, accomplished by moving the legs of the operator. The first to solve this fundamental problem of flight were the Wright Brothers. They obtained lateral control by warping the wings on either side, thus securing a counteracting force by increasing or decreasing the lift on one side or the other of their machine, as necessitated by the attitude assumed after striking a current of air. The first human flight in a power operated airplane was made by Orville Wright on December 17, 1903. It is thus seen that this first subdivision of the first stage of development of the art closes with the attainment of flight, accompanied by the accumulation of a certain amount of scientific knowledge, some gained through laboratory and some through gliding experiments.

The next period, from 1903 to 1914, is characterized particularly by the rapid development of an adjunct of the airplane, the gasoline engine. Only slow progress was made in the development of the airplane itself. Flights of greater speed and longer duration were achieved and a number of improvements made. The outstanding flyers of this period were the Wrights, Curtiss, who was the first to fly from and light on the water, Bleriot, Santos Dumont and Farman. Their contribution to the art was of the nature of invention. There was, however, another type of men at work who were developing and using the basic equipment used in aerodynamic research, the wind tunnel. Experiments of vast scientific value were carried out in France by Eiffel, in Italy by Crocco, in Germany by Prandl, and in England at the National Physical Laboratory. The standard mathematical equations of motion of a rigid body were applied to the disturbed motions of an airplane by Bryan in England, culminating in his book published in 1911. No essential changes in the theory have since been found necessary. This period of development may be considered as closing with the commencement of the war. The art had advanced to such an extent that it may be considered that the mathematical theory was established; scientific experimental equipment was being used, and flights were being made. There was, however, strictly speaking, yet no airplane engineering.

The next stage of development includes the years of the War and the two or three years just following it. The advance of course was by leaps and bounds. However, the progress, both in quantity and quality required, was greater than could be attained on a sound engineering basis. In consequence there were many design failures, only discovered as such after very large quantities of units or completed machines were constructed. Engineering organizations were gotten together, and functioned to as great an extent as was possible under the conditions. The machines produced were, however, more of the nature of designs by individuals than by systematically functioning engineering groups. It may, however, be said that it was during this period of rapid advance that airplane engineering commenced. Certainly the science of aeronautics was well advanced.

The latest stage of development can also be divided into two periods, from 1921 to 1925, and from 1925 to the present time. The former period was characterized in the industry by the successive failure of over half of the companies existant at the close of the war. There were endless controversies and investigations. In the companies

which were able to exist, only slight progress could be made in engineering, as in all but one or two cases the engineering organizations were disbanded. Some advance in the art was made, however, notably in the development of high speed machines. During this period speeds were increased roughly from 150 to 250 miles per hour. Also, although not involved in the engineering progress of the art, this period saw the commencement of commercial aviation in this country, the most noteworthy feature being the establishment and successful operation of the Air Mail. The lack of a definite policy on the part of the government with regard to the industry, received a great deal of attention, and after several Congressional committees had investigated the situation, a group was selected by the President to report fully the conditions found after making a thorough search for facts. This was the Morrow Board, whose report in December 1925 may be considered as one of the most important documents of American aviation. Sound recommendations were made on practically all phases of the subject. The subsequent adoption by Congress of the greater part of the recommendation gave new life to the industry and new impetus to progress in the art.

The latest period of this stage of development may therefore be considered as beginning just after the Morrow Board report was published. Civil aviation started to be a reality; military aviation policy was established, and the industry was in a healthy condition. This permitted the continuance and formation of airplane engineering groups, comparable in organization and in methods used to those of the more firmly established industries. Thus in the present period theory and practice are being coordinated so that aeronautics may be now considered both an art and a science, with designs produced with advance assurance of success, because of the systematic methods employed by the Engineering Departments of the various companies. It has been said that "progress in engineering science, like changes in the sphere of political organization, may be by evolution or by revolution." In general, during the earlier stages of development described above, the latter type held. It is believed that the present stage may be characterized as a period of evolution. There is being made a scientific analysis of experience gained, reducing the lessons to engineering terms. It is a period of "patient spade work," much needed in aviation.

PRESENT STATE OF THE ART

Airplane Engineering

Airplane Engineering is perhaps unique in that it includes within itself practically all other recognized branches of engineering. Although, of course, no branch of engineering when dealt with in practice can be found to be isolated and out of contact of some sort with other arts and sciences, it appears that in Airplane Engineering, more than in other cases, a considerable number of distinct branches of engineering assume a major and equal importance.

Naval Architecture

For the general method of attack of new problems, the airplane engineer borrows from the naval architect. All engineers base their procedure, or should do so, on the experience of others in their field, yet it is perhaps more true in naval architecture than in other branches, that new design is made to follow closely a precedent of former practice; with only sufficient improvement to warrant the new structure. Aside from the general method of attack there are three or four specific

problems which are common to the naval architect and the airplane engineer, and which are treated in much the same manner. These include problems of weight with its distribution, the design of propellers, the determinations by model test of the dynamic factors entering into conditions of equilibrium, and the determination by an entirely different type of model test of the stability and general behavior of floats or hulls on the water, used in designing seaplanes and flying boats.

Without doubt, weight and weight distribution, or balance, are of more importance in airplane design than in any other branch of engineering. The very nature of the duty which an airplane performs, the lifting of objects into the air, indicates that the strictest attention must be paid to weight economy. It has been said that a new design can be judged a success or failure immediately, when after completion, it is placed on the scales. A measure of the efficiency of an airplane is the ratio of the useful or disposable load carried to the gross weight. Obviously, any overweight in the structure reduces by an exactly equal amount the useful load for which the machine was designed. The essential nature of weight economy must be constantly before the airplane engineer.

An airplane must not only be light, it must also be stable. This characteristic is dependent on the location of the center of gravity, or on weight distribution along the longitudinal axis. Therefore, when considering any detail of the design which calculations or actual weighing shows to depart in weight from the original estimate, due account must be given to the effect on balance as well as on reduction in useful load involved.

In the design of the screw propeller the airplane engineer and the naval architect are on common ground. Although the effect, quantitatively, of the various elements of design, are vastly different in the case of a propeller designed for use in air as compared to one for use in water, nevertheless the same problems do exist. It is quite interesting to note that it is only quite recently that air screw designers have come to realize that better results can be obtained by modifying slightly a previously constructed successful design, rather than by attempting to effect a completely new design, based on theoretical considerations, to cover the new conditions. This fact has, of course, long been known and followed by the naval architect.

Before proceeding with the construction of a new design of ship, the naval architect assures himself that the completed vessel will be satisfactory on the water from the standpoint of stability in waves, by testing a model in a towing basin. The airplane designer uses the same equipment in connection with float and hull design for seaplanes, and analogous equipment for determining stability and controllability characteristics of his machine in the air. The latter equipment consists of a wind tunnel, in which all forces and moments on an accurately constructed model are determined for the various attitudes which the airplane may assume. An air stream of known velocity is forced past the model which is mounted on an extremely accurate balance. From the results of such model tests and with a knowledge of the laws of dynamic similarity, the aeronautical engineer can predict, with an accuracy astonishing to the laymen, the characteristics and performance of the full size airplane.

Aeronautical Engineering

Aeronautical engineering is a new branch, peculiar to the design of airplanes. In the present instant it is

defined as covering the limited field of aerodynamics although it is frequently and perhaps more correctly made synonomous with airplane engineering. The aeronautical engineer deals with the forces produced on solid bodies by air in motion. His particular field in airplane design is, therefore, air resistance, stability, and controllability, all of which are determined both analytically and experimentally. The wind tunnel, described above, is the equipment of the aeronautical engineer.

Civil Engineering

In matters of structural design, the methods of the civil engineer are closely followed. They are, however, extended and refined to an extent seldom, if ever, required in bridge or building construction. This refinement of structural analysis is necessitated by the extreme importance of weight saving, above referred to, and by the equal or greater requirement of absolute structural safety. Each detail, as well as the main structural members, must be carefully analyzed for strength and weight; the two factors interact throughout the design. The problems encountered are more novel and varying in character, and, therefore, require closer study than is usually necessary in the structural analyses involved in the older branches of structural engineering, such as the design of bridges or buildings.

Mechanical Engineering

The mechanical engineer is found in an airplane engineering organization in the design staff, where he lays out and designs not only the general arrangement of the complete machine, but also the detail parts and mechanisms. The number and diversity of parts involved in an airplane are frequently not realized. Essentially an airplane consists of a body, the functions of which are to house the crew, passengers, cargo and equipment; a supporting wing structure; stabilizing and control surfaces, with necessary control mechanism; landing gear for alighting on land or water (or both) and the power plant consisting of engine and propeller. All require for proper designing the attention of the mechanical engineer.

Materials Engineering

Under this heading is included the metallurgical and chemical engineering branches. Alloys of steel and aluminum, requiring the attention of men versed in the above sciences, are used extensively in airplane construction. In addition, there are a great number of other special materials used including wood, fabric, dope, paint, and miscellaneous non-ferrous metals. When consideration is given to the ever present need of weight saving, it can be seen that highly trained men must have cognizance of the special problems arising from the use of materials of such a diversified character.

General Engineering Problems

Under this heading fall the problems, common to all engineering concerns, such as drafting, estimating, inspection and standardization. The latter consideration is one requiring constant attention, in order that there may be attained a proper balance between reduced costs of construction on the one hand, and advancement of the art on the other.

The above outline, indicating the branches of engineering involved in an airplane engineering department, will immediately suggest the prime necessity of organization, and the establishment of systematic methods of procedure in producing new designs. Being new and difficult, the field is of necessity inspiring.

EQUIPMENT

The vast expense involved in producing a new design makes it absolutely essential, that insofar as is humanly possible, all chance of failure be eliminated. This makes necessary the availability to the airplane engineering organization of proper equipment. The principle items of equipment necessary are the following:

1. Wind tunnel for predetermining aerodynamic characteristics.
2. Testing machines for determining strength of materials and parts.
3. Static test equipment for testing structural assemblies.
4. Model basin for predetermining hydrodynamic characteristics of floats.
5. Whirl test rig for testing propellers.
6. Flying field and full flight test equipment.

All items should be immediately available for use. The expense involved is, however, more than any company now existent can afford to set aside for this purpose. Nevertheless, it is extremely desirable that the first three and last items be directly available, and operated by the staff of the designing organization. At present all the large companies are equipped with items 2 and 3; several with item 6; one or two with item 1; and none with items 4 and 5, in which cases it is necessary to have recourse to government owned and operated equipment.

In order to establish airplane engineering on a scientific basis, good equipment must be available. It is to be hoped that all major companies will gradually equip themselves with the items above listed. The ideal toward which airplane engineering should develop, is the creation of designs through a systematic procedure, by a group of guided experts using properly functioning equipment.

RESEARCH

Although a great amount of aeronautical research, both along the lines of applied science and pure science, has been accomplished and recorded, there is still a practically limitless field ahead. It is the duty, for the advancement of the art, for each company to bear the burden of its share of research work. At present this must of necessity be confined to the realm of applied science, leaving investigations in pure science to governmental agencies, such as the Laboratory Staff of the National Advisory Committee for Aeronautics and the staffs of the Universities, which have aeronautical courses and laboratories. This duty is being realized more and more, and it is believed that companies will automatically equip themselves, both with laboratories and personnel, as the growth of the industry permits.

DESIGN PROCEDURE

The general function of an Airplane Engineering Department is to develop designs and produce drawings by means of which can be constructed airplanes which are structurally sound; aerodynamically stable and manoeuverable; which possess the specific qualities and characteristics originally specified; and which are so designed as to be susceptible of construction at a profit in competition with the product of other concerns. To attain this end, it is necessary to properly coördinate the work of the engineers who control different phases of the design, as above described. This coördination is, in practice, attained by establishing a definite design procedure which permits each expert to approve the design, at the proper stage of development, and for the features coming under his

cognizance. The procedure believed best adapted for this purpose is the following:

1. A discussion by the experts, in conference, of the design elements laid down in the specification requirements, with an agreement reached on the general type of design to be followed.
2. The development and approval of a general arrangement drawing; descriptive specifications; weight, balance and performance estimates; characteristics sheets; and wind tunnel tests.
3. The development and approval of structural and assembly arrangement drawings; stress analyses, strength tests and weight calculations.
4. Production of detail construction drawings.
5. Construction, with engineering control of inspection and weight and design changes.
6. The superintendence of final weighing of the finished airplane and of flight tests.

CONCLUSION

In the preceding pages, an attempt has been made to trace the development of aviation in terms of progress in the scientific and engineering field. As opposed to the conditions that maintained during the early stages of development, when the men interested in aviation were either pure scientists or inventors, it has been shown that today the engineering phase of the art is operative. With the art on a scientific basis, the engineer can continue the progress in an orderly fashion. It is the job of the airplane engineering organization to coördinate the works of the research laboratory, the statistician and the engineering expert in specific phases of the design, to the end that a reasonable and useful machine, slightly better than anything of its class previously constructed, may come into existence. This indicates, as previously mentioned, the most desirable form of progress, that is through evolution as distinguished from the occasional occurence of more rapid advance (not always lasting) brought about, to use a political term, through revolution. Granting that attainment of more rapid means of transportation of both men and goods is a measure of general progress and prosperity, certainly the benefits to mankind which can be envisioned from aviation are vast and almost limitless. The progress now being made in airplane engineering is extremely gratifying to those deeply interested in its development, and the fact that it now appears to be on a sound basis of organization, comparable with engineering in other branches of the automotive industry, bodes well for the future advance of the art.

The Story of the Airplane Engine

By George F. McLaughlin
Technical Editor, *Aero Digest*

PARALLELING the great strides made in aircraft development, the airplane engine has kept apace, and has governed to a large extent, the limits of progress in the air. From the crude power plants of twenty years ago to the highly efficient, one thousand horsepower engine units of today is a very wide gap, filled between with a technical romance and history which equals that of the airplane itself.

Early Engines

Early experimenters in heavier-than-air flight were defeated at the outset by lack of an engine suitable for the propulsion of the various aircraft types they had conceived. There is no attempt to dim the glory of the Wright brothers' achievements, when it is said that the existence of a suitable engine might have brought the advent of the first flight earlier. It is not surprising, however, that pioneer experimenters met with indifferent results, when it is realized how widely separated are the aerodynamical problems of flight as compared with the mechanical requirements of engine building. These pioneers were essentially scientists with an extremely difficult problem to solve—the problem of sustaining a heavier-than-air vehicle in flight. They were all beset by the question of motor power, which in itself presented its own set of difficulties.

It was the Wright brothers, however, who had the happy combination of a suitable engine, crude though it was, combined with a glider which they had demonstrated beyond all doubt was capable of prolonged flights.

At first, steam was believed to be the best source of power, and one of the pioneers in Europe (Maxim) devised what is even at this date regarded as a highly perfected steam engine for his experiments in flight. One of the first pioneers to use a type of engine now in general use, the internal combustion engine, was Langley, who had a specially constructed engine of this type built to his order by Manley.

The Wright Brothers' Engine

When the Wright brothers concluded, after their many years of gliding experiments, that power-driven aircraft were an immediate possibility, they sought a ready-made automobile-type engine which they hoped might be adaptable to their craft. Diligent search, however, failed to reveal any power plant even remotely possible for their use, and they were forced to temporarily abandon their gliding experiments until they could themselves design and construct an engine light and powerful enough to drive their new plane. Their mechanical ingenuity gave them a tremendous advantage over their rivals for first honors in the air. They were able to produce a four-cylinder engine giving them the power they required—about twelve horsepower.

The first engine built by the Wright brothers weighed about one hundred and seventy pounds. Compared to its power it will be seen that its weight is fourteen pounds for each horsepower developed. When this is further compared to the engines of today which weigh less than two pounds per horsepower, the advance in engine design on this basis alone is at once apparent.

In the matter of reliability there has been an even greater advance. The first flights of the Wright brothers in 1903 were recorded in mere minutes and seconds, due to the fact that the lubrication system of their engine was not developed and it ceased to function after a very brief run. Contrast this with the reliability of today; modern aircraft engines have been tested in runs of more than three hundred hours at full power, with no appreciable diminishing of efficiency. Translated into miles, in an aircraft traveling at one hundred miles an hour, this would be equal to a distance of 30,000 miles. We are inclined to regard the modern automobile engine as a high standard of efficiency, but even forgetting that an auto engine weighs something like fifteen pounds per horsepower, imagine how the engine of your car would withstand a 30,000-mile trip at its maximum power without stop!

Among the most successful pioneers in engine development was Glenn H. Curtiss, who produced several highly efficient engines to drive the aircraft he constructed at Hammondsport shortly after the Wrights made their historic flights. His first conspicuous success in the air was the winning of the speed race at Rheims, France, in 1909, in a plane powered by a marvelous power plant of his own design, which weighed about two hundred and fifty pounds and developed fifty horsepower. This engine weighing five pounds per horsepower was then the most efficient power plant in the world.

THE GNOME AND OTHER ENGINES

In the air-cooled engine types greater efficiency was obtained less than a year later, when the famous Gnome engine was produced. This engine gave thirty-four horsepower and weighed one hundred and thirty-two pounds. This means that the weight per horsepower was 3.9 pounds. Henri Farman, in October, 1909, flew for three hours and four minutes with a Gnome engine. It was in the same year that Louis Bleriot flew across the English Channel in a monoplane powered with a twenty-five-horsepower Anzani engine. The British were roused to activity by this exploit and, in a contest sponsored by Lord Northcliff, Colonel Cody won a prize of £5000 for a flight from London to Manchester. In Germany the Kaiser Prize Contest for the best aviation engine was held in 1913. Competitions of this nature assisted and made possible such successful engines as the Benz and Mercedes.

Between 1907 and 1910 the fifty and eighty-horsepower E. N. V. engines were built in France, and their efficient working made possible numerous short flights during that period.

INFLUENCE OF THE WAR

The war naturally exerted an accelerating influence on aircraft engine development, and in England, France, Germany and the United States, engines of the most varied types made their appearance, improvements being rapid under the stern necessity of war requirements. America's greatest contribution to the war was the conception and production of the standardized Liberty engine which was used in great quantities in airplanes of French and British design. This engine is a twelve-cylinder water-cooled "V" type engine which weighs eight hundred and forty-five pounds and delivers four hundred and twenty horsepower. The weight of two pounds per horsepower is a marked achievement for that period.

ADVANCE OF AIRCRAFT DEPENDS ON ENGINE

The advance of aircraft at present largely depends on the progress of the airplane engine, and improved types of

motors are being built in the United States, Great Britain, Italy and France.

In Great Britain there are forty types of engines in regular production by a dozen manufacturers; in France also about forty types produced by about fifteen manufacturers; in Italy we find about twenty types constructed by ten firms; and in the United States eight concerns produce more than twelve types.

An interesting example of a large aircraft engine is the Napier "Cub," a sixteen-cylinder one thousand-horsepower water-cooled type. With the development of light sport airplanes, a new market opened for low-powered motors and the smallest production engine on the market at this time is the twelve-horsepower French Salmson A. D. 3.

Notable examples of American aircraft engines are the Packard water-cooled eight hundred-horsepower standard and inverted types, and among the air-cooled the Wright "Whirlwind" two hundred-horsepower and the Pratt & Whitney "Wasp" four hundred and twenty-horsepower. Around the latter are designed the latest types of Naval fighting and scouting planes. The air-cooled engine was found particularly advantageous for the Naval work because of the absence of the water-cooling system and its attending complications.

The Pratt & Whitney engines have as their standard equipment a built-in supercharger. The aim of the supercharger is to supply air to the carburetor under a pressure higher than that of the surrounding air. The presence of a supercharger of the type used on the "Wasp" increases the power of the engine at sea level and diminishes the usual drop of power with increase in the altitude. The "Wasp" is a fine example of an air-cooled engine, and can be claimed to be the leading in the world.

REQUIREMENTS FOR ENGINES

The seven major requirements for aircraft engines are: minimum weight per horsepower, minimum consumption of fuel, and oil, minimum frontal area, maximum reliability, maximum durability, minimum initial cost and minimum cost of maintenance. In aiming to meet these requirements great strides have been made, and where obviously one engine may not possess all the desirable attributes, we have a number of proven types of engines today which meet conditions of service in a highly satisfactory manner. In the United States we have water-cooled engines in production ranging in power from two hundred to eight hundred horsepower and air-cooled engines of two hundred and four hundred horsepower which fairly well meet the needs of our requirements for military and commercial use. The trend recently has been toward the air-cooled engine, and a five hundred-horsepower unit of this type is now under development.

At the present time the efforts of engineers are directed toward perfecting a Diesel type of engine. The primary aim is to obtain higher fuel economy and increase the power of the cylinder unit. Superchargers seem to be of high importance in the development of the Diesel type engines.

Gas turbines and steam engines have also been studied, and the two-cycle explosion type has its followers. Two-cycle and heavy oil engines have certain practical advantages over more radical types of the gas turbine and the steam engine. It is hard to predict what is possible in metallurgical progress, and should we obtain materials capable of resisting higher loads at higher temperatures, designs impos-

sible today may become practically possible. The fact that prominent engineers are behind these researches is a fair guarantee that the four-cycle explosion-type engine as we know it today, in spite of its high state of perfection, will in the future be superseded by a mechanism much more economical in fuel and power, and of greater power in relation to its weight.

Airplanes in National Defense

By General William Mitchell, D.S.C., D.S.M.

Formerly Commander Air Forces, A.E.F. and Director of Military Aeronautics, United States Army.

TO speak of "airplanes" in national defense as applied to an Air Force is much the same as speaking of the "rifle" as applied to an army, or the "warship" as applied to a navy. Therefore, in considering the "airplane in national defense" we must think of it as the vehicle which is the means of conveying "air force" through the air, much in the same way that a man's legs are the final analysis of land force, or the vessel is the vehicle of sea force.

The Problem

National defense means the protection of the country, primarily, from outside aggression, international war, not internal disturbances for which we have police forces and constabularies.

Each nation has its special problem in national defense. We, in the United States, have a comparatively simple one. We have a compact country, rich in practically every element necessary to maintain ourselves in an international war. We are the most self-contained country in the world, and should be able to defend ourselves against the world, providing we apply the elements which the Almighty has given us in a common sense way.

The term "war" signifies the condition which results when one nation attempts to impose its will on another by physical means. The methods employed are directed towards paralyzing the ability to make war on the part of the enemy, while at the same time protecting one's own power to continue the strife.

Ancient and Modern Methods

If the vital centers of the opposing nation are destroyed, or made incapable of carrying out their part in the upkeep of the people, resistance is no longer possible, and capitulation or surrender is the outcome.

According to ancient methods of warfare, these vital centers of a country were protected by groups of men put out in front of them, to prevent other men from moving along the ground and possessing themselves of the vital places. People then fought in only one dimension, the surface of the earth, which was the decisive area, and the surface of the sea, which was an auxiliary area. Now military operations have been carried: (1) into the air, which covers the whole earth with a highway ten miles deep; and (2) under the sea, which gives the maximum amount of concealment to the vessels operating in the water.

The methods of land armies and surface navies have changed little since men first began to fight on the land and the water.

Improvements in Weapons

Each succeeding military epoch has seen an improvement in the mechanics of conducting war. Each improvement in weapons has given the defense more power to arrest the advance of the opposing force. Sixty years ago in our Civil War, one man well entrenched might have been able to hold off five attacking him. Now one man may be able to hold off fifty.

These improvements in weapons have operated to make land armies more and more incapable of obtaining victory over the opposing state. A climax was reached in the European or World War. There the armies, after some preliminary maneuvering, sat down in a series of trenches and indulged, during four years, in an orgy of killing that merely led to the complete exhaustion of all the combatants without substantial gain to any. The armies only advanced or retreated about sixty miles during this whole time. The directing heads of the armies were entirely unable to bring about victory for either side. Had this method of warfare been continued, it might have led to an entire extinction of what we call civilization today. Just as happened in Europe, after the fall of the Roman Empire, when with a destruction of all means for preserving the peace and maintaining a governmental organization, the known world reverted to a state of savagery which we call the dark ages. Armies, therefore, have become holders of ground, they cannot advance over it with rapidity to the vital centers of an opposing nation and bring about a quick and decisive victory. Air forces with the airplane are the means of going straight to the vital centers of the opposing side and paralyzing them.

ON THE SEA

On the sea the surface vessels are entirely at the mercy of air forces with the airplane. The greatest battleship is even more vulnerable than the smallest torpedo boat. This is because the battle ship cannot conceal itself, is comparatively immobile and inert as far as air power is concerned, and is possessed of no adequate means of defending itself against air power. Therefore, the surface fleet, as a means of controlling the sea in a contest between two great industrial nations, has lost its value. What main operations are carried on in the water in the future will be handled by submarines which proved decisively in the last war what their value is. The keeping of large surface navies, by some of the great powers at present, is merely a result of inertia, and the maintenance of the immense interests both personal and financial, which man the navies and supply and sell the equipment to the governments.

IN THE AIR

The airplane is now the arbiter of a nation's destiny. There are no longer frontiers, in the old way. A nation's frontier now is a blanket of air ten miles thick, laid entirely over it. To illustrate, let us consider the vital area in the United States. It lies in the triangle, Chicago, Bangor, Maine, and Chesapeake Bay. Roughly the distances are about 750 miles on a side, or from four to six hours' flying with modern aircraft. In this district are located New York, Philadelphia, Washington, Pittsburgh with all its iron, Pennsylvania with its coal and oil, the great cities of the middle west, Detroit with the world's motor industry, Cleveland, the railway neck or straight, as it might be termed, south of Sandusky, Ohio, where the great transcontinental lines come together, and then Chicago the keystone of our arch of dominion. Two-thirds of all we possess as a nation; people, agriculture, manufactories, animal industry, wealth, lies there. Suppose that New York were paralyzed. By this we mean made uninhabitable for its population so they would have to leave it and go to the open fields and forests fifty or a hundred miles away. The population of the area within twenty-five miles of New York is about as great as that of all of Canada, almost twice that of

Australia and more than the populations of some of the countries of Europe. A few shells, gas, explosive or incendiary landed in Manhattan would cause a complete evacuation. It is not necessary to destroy the physical structure of a city today to paralyze it. That was a method of ground armies because they could do nothing else.

Aircraft can stand off a hundred or more miles and launch air torpedoes carrying hundreds of pounds of gas, explosive or fire-making compounds, and hit a place like New York practically every time. The air torpedo is like an airplane controlled by gyroscopes which will pilot it in the direction and for the distance desired. In case the wind deflects it from its course it may be corrected by radio or wireless control. Either large airplanes or dirigible airships, such as the Zeppelin, that last crossed the Atlantic are able to carry these. Airplanes do not have to fly over a place to attack it. Not only may they use the air torpedo but they can also put wings on their bombs which will allow them to glide for many miles to their objective. The variety and power of weapons that aircraft can carry are the greatest that the world has ever seen. Poison gas can be sprayed over fields and agricultural areas so as to kill the vegetation, and prevent its being used for long periods. All live stock, as well as people, may be destroyed in a similar manner.

Suppose that New York, Chicago, and the railways south of Sandusky were paralyzed. It would disrupt our whole existence as a nation. Suppose next that Pittsburgh, Detroit, and the Mackinaw Canal were put out of business, and that the air attacks against these places were continued so as to keep them paralyzed. Within a very short time the nation would have to capitulate or starve to death.

These places can be attacked directly through the air from Europe now, and either directly or with auxiliary bases from Asia. Such is the carrying capacity and power of navigation of aircraft that can be constructed at this time.

Armies and navies are entirely powerless to stop such proceedings, because no weapon or device operated from the ground is able to stop or even remotely hinder air operations.

V. THE ADVANTAGE OF THE AIR

Suppose that New York and Philadelphia were the vital centers of two states at war with each other. Suppose that New York had a tremendously strong army but a very weak air force, but that Philadelphia had a very weak army and an immense air force. The New York army would take up its march towards Philadelphia. It would make two and one-half miles an hour. The Philadelphia army would entrench near the Delaware River where fifty times its number of men on the ground could not dislodge it. The Philadelphia air force would launch a gas and explosive bomb attack against New York. It would take one hour and a half to fly there, and forty minutes to make the air attack. New York, the air fields of its air forces, and probably its army would be destroyed in less than a day, and the war would be over. The armies would merely hold the ground. If they were too large they would eat up so much food, and require so much equipment, that it is conceivable that they might take so much vital power away from the population and air power as to almost defeat themselves. A nation today can very easily have too large an army.

Suppose that this country were menaced by a European nation possessing an immense navy, and that we had no navy but a well-ordered air

force. We can exist, fortunately, without outside assistance; in fact we would feel the lack of very little no matter whether we had all the sea communications or not. Should the opposing surface navy venture out into the sea it forms the easiest object of attack and destruction which has ever been presented in warfare. In fact, in a modern war these vessels would probably be destroyed before they ventured forth from their harbors. Aircraft using the air torpedo, the water torpedo, the gliding bomb, the dropped bomb, gas curtains, mines and gun fire are able to destroy and sink these leviathans with comparatively little effort in lives and expenditure. The submarine alone, of a navy's devices, forms a difficult problem for the airplane to handle. Concealed beneath the surface of the sea it is difficult to find during the day; cruising or lying quietly on the surface of the sea at night it is inconspicuous compared to the great surface vessels. Aircraft, however, provide the best means of defense against submarines, except submarines themselves. As a means of defending our coasts against the old-fashioned naval attack, aircraft are an absolute and positive protection. In fact no nation would be foolish enough to send a navy to certain destruction against a nation well provided with an air force.

NO DEFENSE AGAINST AN AIR FORCE

What is the defense against an air force then, it may be asked? The answer is that there is no absolute defense against an air force. The air is such a tremendous place that it is practically impossible to find each and every aircraft that an enemy possesses. An air force, however, is the only means of meeting an opposing air force. In war the nation that gets in the first great air blow amidst the enemy is the one that will win. Should war be declared tomorrow between England and France, France would launch a night attack against London with a thousand airplanes tomorrow night. London is only forty minutes' flight from the French coast. England would have to attack Paris two and a half hours away with less than half the airplanes that France has. The attack would be decisive; London would be destroyed. In a couple of weeks the war would be over. England's army and navy would do her no good. She knows this full well, but on account of her geographic position and the location and configuration of her insular country she cannot escape it.

The use of aircraft in war might be likened to the "punch" which two prize fighters are able to deliver. We might consider that neither had any "defense" and could hit the other at will. One with the "punch" would "land" no matter how the other hit, and the fight would be over. Never has there been any power or force in war, where it has been as important to get in the first "punch" as is the case with air power. In the old days people might pick up pitchforks and flint lock muskets and defend themselves. Now to construct the equipment for air power takes years of preparation by men that know what it is all about. Armies and navies are entirely incapable of either visioning what it is or carrying it out. The United States never sent a completely equipped airplane of American manufacture to the War in Europe.

The contest now between the great nations, to protect their trade, their institutions and their national integrity, is not huge armies, not tremendous and costly naval bases scattered over the world, but the development of *air power*, *air bases* and *aircraft*.

THE AIRPLANE—THE FUTURE ARBITER OF THE WORLD'S DESTINY

The unusual thing about air power is that a commercial air transport airplane is practically as useful as what is termed a military plane. One may be transformed into the other by merely loading the weapons of destruction, bombs and bomb sights, on it. That is the work of a few minutes. England and France thought that they were clipping Germany's fighting wings when they put into the Treaty of Versailles that Germany should produce no military aircraft. Germany has built a great "civil" aviation. Germany has the greatest dye factories and chemical factories in the world. These factories can be transformed into poison gas sources in a day. The "commercial" airplanes can be loaded and dispatched to London or Paris over night and inflict incalculable harm. Germany today holds "up her sleeve" the power of the greatest military surprise of the ages. More than the surprise of her "Big Berthas," more than her gas, and more than the great mobility of her troops in the last war.

Airplanes and synthetic chemistry hold the future national defense in their hands. The nation that has these will dominate, because it will be able to exist.

Therefore, when we consider "the airplane in national defense," as this article is entitled, we must look to the future, not to the past. We must relegate armies and navies to a place in the glass case of a dusty museum, which contains examples of the dinosaur, the mammoth, and the cave bear. They still must be kept, because we must always maintain something that is still sure and useful in its particular sphere as the dinosaur was. But we must not entrust our national defense to these honored but obsolete services, because they will surely bring us to the Scilla of the fixed and narrow routine of the armies, and the Carybdis of the "brass hats" and organized buncombe of the navies. *The airplane is the future arbiter of the world's destiny.*

The Air Mail

By Honorable W. Irving Glover
Second Assistant Postmaster General

As the time is fast approaching when the Post Office Department will relinquish the operation of the Air Mail Service in favor of private contractors, it appears fitting that a brief history and summary of the accomplishments of the service be given.

The Post Office Service

The first air mail route in the United States was established between Washington, D. C., and New York City on May 15, 1918. The service was inaugurated in conjunction with the War Department. The War Department furnished planes and personnel and handled flying and maintenance operations, and the Post Office Department handled the mail and matters pertaining thereto. On August 12, 1918, the Post Office Department took over the entire operation of the route, furnishing its own equipment and personnel. A two-way six-day-a-week schedule was maintained.

The New York-Washington route was operated continuously from its inception until May 31, 1921, when it was discontinued. During this period the Department had been working toward the establishment of a transcontinental service from New York to San Francisco. On May 15, 1919, the first leg was established between Cleveland and Chicago; the second leg, New York-Cleveland, on July 1, 1919; the third leg, Chicago-Omaha, on May 15, 1920; and the last leg, Omaha-San Francisco, on September 8, 1920. However, at this time no through schedules were operated, mail being relayed by plane to advance delivery at destination. For instance, mails were flown from Chicago, Illinois, to North Platte, Nebraska, and placed on a train that had left Chicago approximately twenty-four hours earlier. No extra charge was made for this service.

A route was established between Chicago and St. Louis on August 16, 1920, and discontinued on June 30, 1921. Another route, between Chicago and the twin cities (Minneapolis and St. Paul, Minn.) was established December 1, 1920, and discontinued June 30, 1921.

The 32-hour daily schedule between New York and San Francisco, involving night flying between Chicago and Salt Lake City, was inaugurated July 1, 1924. Mails were carried entirely by plane between cities located on the route. Increased postage rates for this service were charged.

On July 1, 1925, a five-night-per-week schedule of overnight service between New York and Chicago was established. This service was made daily as of May 15, 1926. Mail posted at the close of the business day in New York or Chicago is delivered to the addressee the following morning in the cities named. This effects a saving of a whole business day and is comparable to night letter service of telegraph companies.

Planes Used

When the service was inaugurated in 1918, Curtiss JN4H planes with Hispano-Suiza motors were used. Soon after the Post Office Department took over the details of operation in August of 1918 a number of Standard

Aircraft Company mail planes were purchased. These were also equipped with Hispano-Suiza motors and carried two hundred pounds of mail.

Rebuilt DeHaviland planes with Liberty motors were largely used as the various legs of the transcontinental route were established. However, at one time or another, planes of the following types were used extensively: Curtiss R4, with Liberty motor; Curtiss HA, with Liberty motor; DeHaviland, with two Hall Scott L6 motors; Martin mail planes, with two Liberty motors; JL6 (Junker) planes with 240 H. P. BMW motors.

By an elimination process from the inception of the service extending to the year 1922, the service had standardized on DH planes with Liberty motors and disposed of all other types. A number of factors contributed to this end. Unused stocks of Liberty motors were available and were to be had at nominal cost. Improvements made on the Liberty motor, such as heavy stub tooth gears, drilled pistons and improved oil pump, indicated its reliability and dependability as comparable with the latest developments of the time.

A number of DeHaviland planes were obtained by transfer from the War and Navy Departments. Remodeled and rebuilt into mail planes, they were speedy, reliable, long-lived, and capable of carrying a mail load of five hundred pounds. Besides, experience had proven they were a comparatively safe plane to operate.

Owing to increased use of the superior service offered by the speedy delivery of letters by air mail, and the establishment of numerous contract routes in 1926, a plane capable of carrying a larger load than that accommodated by DeHaviland planes became necessary. As a result of competition among various aircraft manufacturers to secure a plane superior to the DeHaviland, fifty-one Douglas mail planes were purchased in 1926. These are now used between New York and Salt Lake City. DeHavilands are in use between Salt Lake City and San Francisco. The most noticeable advantage of the new equipment is increased speed and ability to carry twice the load of a DH.

In the early days special rates were charged on mail carried by airplane, but due to the lack of patronage in the year 1919 the extra charge was discontinued, and ordinary mail was carried. Effective July 1, 1924, when the through transcontinental service was inaugurated, special airplane postage rates were again put into effect, and since that time only mail bearing the special rate of postage has been handled by airplane.

GROWTH OF SERVICE

There has been a consistent steady growth in the use of the service since the transcontinental schedule went into effect. The average daily load on the transcontinental in July, 1924, was 621 pounds; in July, 1925, 757 pounds; in July, 1926, 832 pounds; and in December, 1926, 1106 pounds.

A major portion of the increase in July, 1926, can be properly attributed to the contract route feeder lines established in 1926. It is expected that the establishment of a domestic universal rate of postage of ten cents per half ounce or fraction thereof, regardless of distance or contract routes traversed, will have a stimulating effect on the amount of mail handled. This new rate went into effect February 1, 1927. A further reduction to ten cents *per ounce* is being given serious consideration at this time.

WEATHER DIFFICULTIES

One of the first and most difficult problems to confront the Post Office

Department when it began the operation of aircraft was inclement weather conditions. And today, despite what has been learned and what has been accomplished, "weather" is the outstanding cause of delayed and defaulted trips. It is now possible and even practicable to fly what in 1918 and 1919 was termed bad weather. However, at the present time mail planes are unable to attempt trips due solely to weather conditions. For instance, freezing mist or rain will bring a plane down in a very short time. It is possible to fly through or over fog or low clouds encountered on a trip, but no means have been developed whereby it is practicable for a plane to be landed safely on a field covered by a dense fog.

When the Department began to use Liberty motors it was not an uncommon occurrence to have delayed and incompleted trips due to motor trouble. However, by developing and perfecting rigid inspection, servicing and overhauling methods, actual forced landings on account of motor trouble are a rare occurrence. Likewise, forced landings on account of failure of the plane or plane parts are almost unheard of, due to proper inspection and servicing.

CROSS-COUNTRY NIGHT FLYING

When in 1923 the Post Office Department decided to carry out certain experiments to determine if cross-country night flying on regular schedule was possible or practicable, a momentous step in the development of aviation was taken. Up to this time very little night flying had been done. The U. S. Army Air Service had carried on some experiments and developed certain necessary equipment, but had attempted very little regular scheduled cross-country flying at night. The Army obligingly placed all the knowledge they had gleaned from their experiments at the disposal of the Post Office Department. Beacon lights were installed between Chicago and Cheyenne, planes were equipped with landing lights, emergency fields were prepared and marked, and terminal fields lighted. Pilots were given an opportunity to make practice night flights. In August of 1923, a regular schedule was flown between New York and San Francisco for a period of four days, the portion of the route between Chicago and Cheyenne being flown at night. The experiment was a complete success and night flying was an accomplished fact. It could be done.

The remainder of 1923 and the first half of 1924 were spent in preparing for the inauguration of a regular transcontinental service on July 1, 1924. The service went into effect as planned and has been operating continuously since, with only slight changes in schedule, and with a performance percentage of approximately ninety-four per cent. When means are found to circumvent weather that is now impossible, a schedule approximating one hundred per cent will be possible.

Numerous changes in the lighted airway looking toward a more efficient and economical administration have been made. Additional lights have been installed, providing a powerful rotating beacon at approximately every fifteen miles.

A brief summary of the work done in connection with the inauguration of night flying will give some idea of the task. In the last half of 1923 and the first half of 1924 the following special work was accomplished: 289 flashing gas beacons were installed between Chicago and Cheyenne; 34 emergency landing fields between the same points were rented, equipped with rotating electric beacons, boundary markers, and telephones; 5 terminal landing

WHAT AIR MAIL DOES TO THE MAP!
Distances from New York Reduced in Proportion to Time Saved by Air Mail
NEW YORK LEAVING 6.30 PM
CHICAGO
DALLAS
FT. WORTH
SEATTLE
SAN FRANCISCO
LOS ANGELES
PACIFIC COAST BY AIR MAIL
PACIFIC COAST BY RAIL
AIR MAIL ROUTES OPERATING JANUARY 1927
TYPICAL RAIL CONNECTION
AIR MAIL ROUTES SCHEDULED FOR OPERATION 1927
COURTESY OF NATIONAL AIR TRANSPORT INC.

fields were equipped with beacons, flood lights and boundary markers; 17 planes were equipped with luminous instruments, landing lights and parachute flares. The necessary organization to handle operations both in the air and on the ground was brought up to a high degree of efficiency.

The lighted airway was extended eastward from Chicago to Cleveland in the summer of 1924; westward to Rock Springs at the same time; from Cleveland to New York in the spring of 1925; and from Rock Springs to Salt Lake City in the fall of the same year.

These last two extensions involved difficulties peculiar to the country over which laid out. The Cleveland-Chicago leg traverses the Allegheny Mountain Range, offering serious difficulty in the establishment of emergency landing fields and locations of beacon lights on mountain tops that would be both visible to a pilot flying over and accessible from the ground. The leg from Rock Springs to Salt Lake City traverses the Laramie and Wasatch Ranges of the Rocky Mountains, an area that is very sparsely settled.

Quick Communication System Essential

An efficient, quick and dependable communication system is essential to the operation of aircraft on regular schedule cross country. It is necessary to have promptly, when needed, weather reports and ship movements. The Post Office Department first tried out a leased land wire over portions of the route, but discarded it in favor of a transcontinental radio service. Radio stations are located at fifteen terminal fields on the transcontinental route. Of these nine stand continuous watches 365 days per year. Although in the past the Department has experimented with radio sets installed in planes, and pilot to ground communication has been maintained with varying success, this development has not reached a stage where it is of real practical value. However, results to date show promise, and it can reasonably be expected in the near future that this desired development will be an accomplished fact. Some aircraft operators are experimenting at this time. Besides, the Bureau of Standards of the Department of Commerce is carrying on further development work.

A forward step was taken when the Postmaster General was authorized by law to enter into contracts for the transportation of mail by aircraft. This led to the establishment of several contract lines early in 1926.

Contract Routes

Contract routes have been established and are now in operation between Los Angeles, Calif., Las Vegas, Nevada, and Salt Lake City, Utah; Pasco, Wash., Boise, Idaho and Salt Lake City, Utah; Pueblo, Colorado Springs and Denver, Colo., and Cheyenne, Wyo.; St. Paul and Minneapolis, Minn., LaCrosse and Milwaukee, Wis., and Chicago, Ill.; Ft. Worth and Dallas, Tex., Oklahoma City, and Ponea City, Okla., Wichita, Kan., Kansas City and St. Joseph, Mo., Moline and Chicago, Ill.; St. Louis, Mo., Springfield, Peoria and Chicago, Ill.; Chicago, Ill., and Detroit, Mich.; Detroit, Mich., and Cleveland, Ohio; New York City, Hartford, Conn., and Boston, Mass.; Seattle, Wash., Portland and Medford, Ore.; San Francisco, Fresno, Bakersfield and Los Angeles, Calif. All of the above routes except the last named make direct connection with the government-operated transcontinental or New York-Chicago overnight service delivering mail to and receiving mail therefrom.

The establishment of the contract

COURTESY OF NATIONAL AIR TRANSPORT INC.

service increased the number of people directly served by the Air Mail Service materially, and resulted in an increase in mail handled of practically fifty per cent.

Arrangements have been completed whereby the portion of the transcontinental route between Chicago and San Francisco will become contract service on or about July 1, of this year. It is expected that the portion between Chicago and New York will be let out to contract in the near future. The Post Office Department thereby will discontinue the operation of aircraft entirely.

ACCOMPLISHMENTS OF THE POST OFFICE DEPARTMENT

It is believed that the Department can, without fear of contradiction, lay claim to a number of accomplishments in the field of commercial aviation. In the first place, it has kept aviation before the public and brought many people into a closer feeling of relationship with aircraft. Secondly, the Post office Department has demonstrated that it is possible to maintain a fairly regular schedule of plane operations in all seasons, both day and night. Furthermore, a considerable portion of the American public has been convinced of the safety of air transportation. At this writing the Air Mail Service has flown approximately 2,500,000 miles since there has been a serious accident in the service. During the calendar year 1926 there was one fatal accident, and two during the calendar year 1925.

The Air Mail Service was awarded the Collier trophy for the most important contributions to the development of aeronautics in the year 1922, for the unusual record of safety established; in the year 1923 for demonstrating the practicability of night flying. Recently the Harmon trophy for the United States was awarded to Pilot Shirley J. Short of the Air Mail Service for his outstanding flying record for the year 1926.

Now that the Air Mail Service will be operated entirely by private contract, private enterprise no doubt will stimulate the use of the service and carry on the development of commercial aviation to a point little dreamed of at this time.

Aerial Photography

Its Development and Future

By Sherman M. Fairchild
President, Fairchild Aviation Corporation

WHILST aerial photography was used to a limited extent in the years preceding the World War, it owes its rapid development to the experiences gained during four and a half years of concentrated warfare. Like aeronautics in general, this branch of the active services, with practically unlimited funds at its command, made enormous progress. Naturally, commercial aerial photography profited from the knowledge so gained, and it is gratifying to observe that American aerial photographers have kept well to the fore in this particular branch of aviation.

Early Types of Cameras Used

At first, ordinary cameras with telescoping leather bellows were employed, merely reinforced with protective cones. But this makeshift arrangement was soon found to be utterly inadequate, and the need for a specially designed and constructed apparatus became at once apparent.

The second logical step was, therefore, a new type of aerial camera, hand-operated and using a plate or film magazine. Whilst admittedly giving better results than the earlier cameras, they were still far from perfect and could in no way be compared with the modern aerial camera of today.

Even until recently the great majority of aerial picture makers, enlisted in peaceful pursuits, performed a dual function. They were used for the making of "obliques" as well as of "mosaics." "Obliques" are in reality "bird's-eye" views, taken from a slightly steeper angle than when usually seen from the ground, objects in the foreground and center standing out clearly, whilst those further back show a perceptible loss of detail, due to their greater distance and the usual atmospheric haze so close to the ground. In "mosaics" all pictures are taken from a predetermined height, in a true vertical position, and thus enable the aerial photographer to assemble a complete map of the territory under observation, by joining the individual photos "shingle"—fashion. That is called "aerial mapping." As can readily be imagined this procedure, which depended entirely upon the constant alertness of the observer-photographer, sometimes left gaps between adjacent exposures of film, so that frequently a new set of pictures had to be taken, in order to complete a mosaic.

The Latest Military Model *K-8*

The need for a camera which would automatically produce a series of consecutive and overlapping photographs entirely independent, if possible, of the human element, led the Fairchild Aerial Camera Corporation of New York to develop a "fully-automatic" aerial camera, known as the Military Model *K-8*. This is considered the greatest forward step, since the incipiency of aerial photography.

No longer need an observer-photographer be carried. This new camera may now be installed in a fast single-seater pursuit plane. Merely the "twist of the wrist" in setting the dial of the intervalometer on the instrument board, enables the pilot to "shoot"

an entire city from an altitude of six miles, unheard and unseen.

Briefly, the camera is mounted in the plane with the lens pointing downward through an opening in the fuselage. The elevation at which the plane must be flown is determined. To instance an example: If the area under observation is to be mapped on a scale of 800 feet per inch, and a lens of 20-inch focal length is employed, multiplication of the two factors (800×20) gives the altitude in feet which the plane must maintain (16,000 feet).

The pilot outlines upon U. S. Geodetic Survey sheets the area to be covered and also marks the guide or flight lines. According to this marked map the "job is flown." The pilot flies back and forth along the guide lines, making "strips," until the full area has been covered.

The photographic film is covered by exposures $7\frac{1}{2}$ by $9\frac{1}{2}$ inches each, the larger dimension forming the width of the film. However, the net effective area of each exposure is only about one-fifth of the picture. This is because only the center part is truly vertical, while the marginal objects appear slightly oblique. Hence the photographer times the consecutive exposures so that they overlap "shingle"—fashion by about sixty per cent, and the pilot plots his flight lines so that the strips overlap nearly fifty per cent.

The overlap also permits of stereoscopic study of the terrain, which adds the third dimension, so indispensable to the correct interpretation of many objects on the ground.

With the completion of the photography the air work is done, and the films, after developing and printing, go to the mapping department.

AERIAL MAPPING

The mosaic or aerial photographic map is assembled by first plotting certain survey points upon a large board, and then superimposing selected sections of aerial photos, after they have been carefully corrected to scale. This master map is then re-photographed in large sections, from which any desired number of copies may be made. Enlargements up to four diameters may be made to bring out certain details, without perceptible loss of definition.

The practical applications of aerial mapping are manifold, indeed. Hydraulic companies are having their watersheds surveyed by this method. Nearly all the larger light and power companies have had their transmission lines plotted from the air. Congested territories all over the country, composed of multiple city groups, are being mapped for regional planning. Several states are contemplating aerial mapping of their entire commonwealths.

USES FOR AERIAL MAPS

The many uses for aerial maps are practically unlimited. From them the hydraulic engineer can locate potential power sites. The department of forestry can interpret them accurately, locate fire towers, mark fire lanes, and apportion ranger patrols. The lumberman will quickly spot denuded areas, where acres of stumps and dry brook beds demand reforestation. State highway departments will now be able to plan speedily and accurately new main arteries. From these maps the agricultural departments can figure the percentage of land under cultivation, mark waste lands for reclamation, and thus assure maximum agricultural efficiency for the entire state. The problem of adequate water supply for large metropolitan areas will be solved by the most intensive study of aerial maps for the logical locations of future reservoirs and basins.

Individual cities and towns also benefit greatly from aerial maps, their

various departments adapting them to their respective needs. In this manner the board of education may locate ideal sites for schools, to suit the ever changing population. The police and highway departments can solve their traffic problems better. A single glance will show the necessity of widening certain thoroughfares at strategic points, determine better parking facilities for motor cars, plot layouts for new streets and boulevards, and tell, without visiting the location, whether or not property values make condemnation proceedings prohibitive. The board of tax assessors can conclusively point out the factors of improvement which helped to increase the value of a citizen's property. The city planning and zoning departments can do their work more rapidly and intelligently, because all factors pertaining to their particular problems are registered photographically and to scale, covering the entire city. The police, fire, water and sewer departments find these aerial maps of inestimable value in their many daily tasks.

The city engineer welcomes them to elucidate his projects, and to save a good deal of field work, thanks to the exact reproduction of the terrain under survey. Gas, electric and telephone companies find these maps indispensable in solving their problems of distribution.

Aerial photography has also played a major part on scientific expeditions, and was employed with marked success on Dr. Alexander Hamilton Rice's trip through virgin territory into Brazil along the Amazon River.

New possibilities for the application of aerial photography are presenting themselves as the industry develops. Even long before aerial mapping was perfected, oblique aerial photographs were used for advertising, real estate developments, etc. They are naturally more easily interpreted than a vertical map, for oblique views are pictures such as our eyes are accustomed to gaze upon from high buildings, mountains, or other points of vantage.

Pedagogues and authors of textbooks, especially those on geology, geography and history, have used aerial photographs for illustrations. Present indications are that this type of illustration in teaching will probably cause a great many of our schools and colleges to employ more and more aerial pictures and lantern slides in the future.

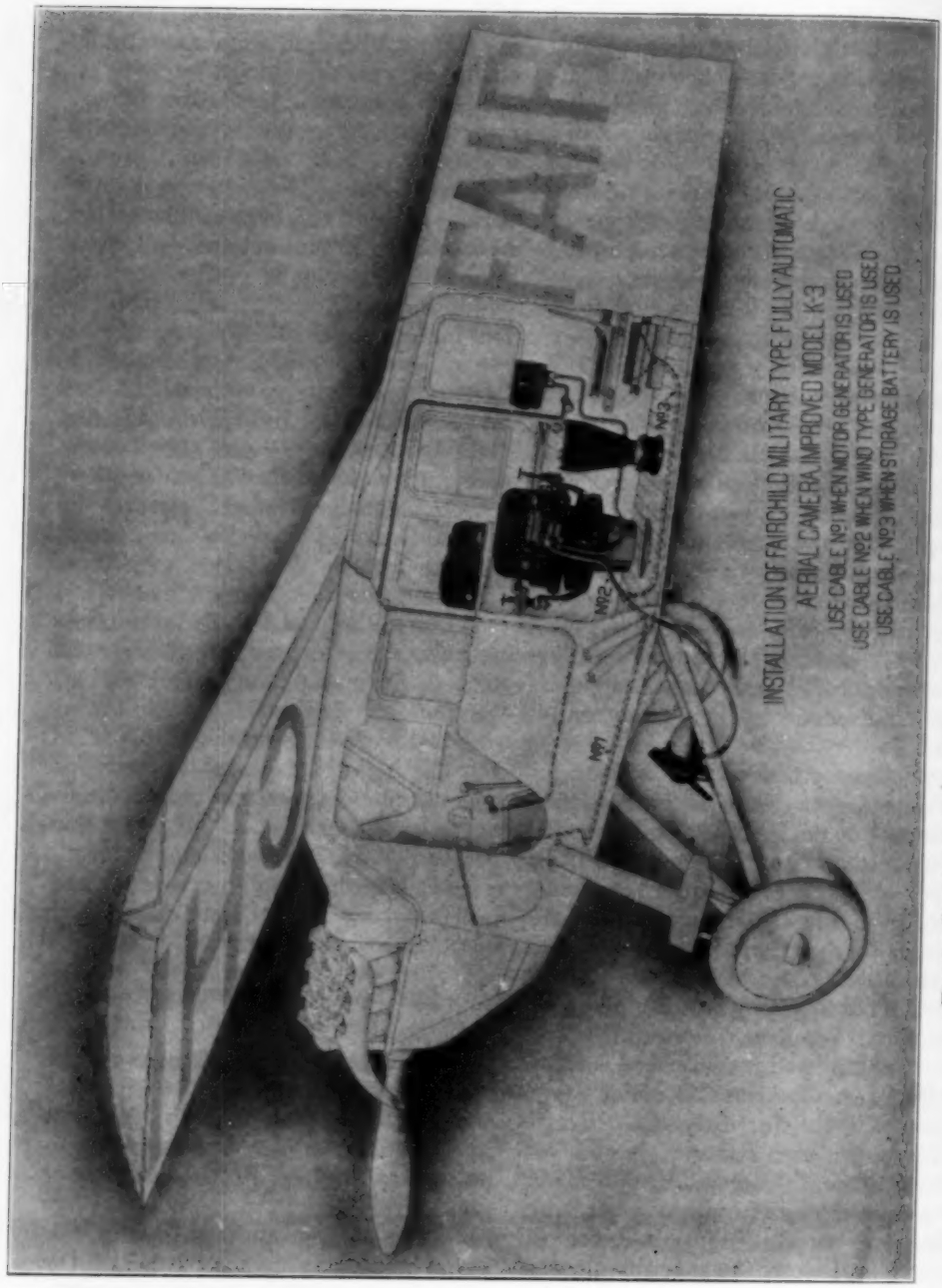
Captains of industry have been quick to realize the accuracy of aerial pictures for plant layouts. In several instances, aerial photos have been accepted in court of law as conclusive evidence.

The painting of aerial pictures in natural tints has opened a new avenue of sales for the decoration of homes, clubs and business offices.

While in the past individual municipalities have contracted for aerial surveys for city planning and zoning, tax, parkway and traffic studies, entire counties were mapped in 1926. This is a fair indication of public needs for regional planning, rather than individual municipal problems. The next few years will see entire states mapped from the air, at a considerable saving of time for the surveyors, and a great saving of money for the taxpayer.

THE CAMERA IS CONSTANTLY IMPROVED

In aerial photography, as in any other line of business, supply, both in kind and in volume, is controlled by demand. And if the present day demand seems to lie at least partly in the direction of greater personal comfort and efficiency for the surveyor and the public, the aerial photographer may consider the situation something of a compliment to himself. Presumably he has gained a lap in the race and now he may catch


INSTALLATION OF FAIRCHILD MILITARY TYPE FULLY AUTOMATIC
AERIAL CAMERA IMPROVED MODEL K-3
USE CABLE No1 WHEN MOTOR GENERATOR IS USED
USE CABLE No2 WHEN WIND TYPE GENERATOR IS USED
USE CABLE No3 WHEN STORAGE BATTERY IS USED
No1
No2
No3

TYPICAL INSTALLATION OF FAIRCHILD MILITARY AUTOMATIC AERIAL CAMERA

The camera may be seen in the center, with a spare magazine above it. At the right is the view finder, whilst the intervalometer is mounted above it. Beneath the fuselage appears the propeller-driven dynamo, which supplies current to the camera.

his breath. As a matter of fact, however, he isn't resting. Eternal vigilance, he knows, is the price of progress; and he's busy.

He's busy, specifically, at the task of fitting the aerial camera more accurately to the present-day needs. Aerial photography is increasing in volume; the demands made upon it are becoming more stringent. The situation demands—and the future will continue to demand—aerial maps that are accurate and to scale, maps that may be enlarged several diameters without perceptible loss of detail. The engineer demands—and will continue to demand—an aerial camera that will be absolutely automatic, a camera that will "handle" easily, a camera whose operation insures a maximum of safety and a minimum of muscular and mental effort.

And so the aerial camera manufacturer, to whom demand always stands as a challenge, is busy. He's busy in many different directions and at many spots in the camera's anatomy. He's busy with old problems and with new ones.

The outstanding accomplishment in aerial photographic picture makers is the Fairchild Automatic Recording Camera. Used as standard equipment by the U. S. Air Services, the Royal Canadian Air Force and numerous foreign governments, this camera is almost human in its action, and does what no other camera can do at this time.

On a strip of 75 feet of film it will take 115 consecutive exposures, 7 by 9 inches in size, and all the pilot has to do is to set the intervalometer on his instrument board in the plane, and the camera does the rest. In other words, no additional observer-photographer is needed, and, in addition to the aerial picture under observation, complete engineering data, such as the time of the exposure, the focal length of the lens, the serial number of the camera, number of exposures, the altitude and level of the camera, and any written notes the pilot may add are permanently and accurately recorded.

In this manner the element of human errors has been completely eliminated. Extra film magazines may be slipped in position in less than five seconds, and twice the area may now be mapped without stopping the camera mechanism. With one single loading an area of 180 square miles may be accurately mapped from a height of 10,000 feet.

The "between-the-lens" shutter, in addition to perfect light distribution over the entire film face, assures greater speeds, and is absolutely unaffected from the vicissitudes of climatic extremes.

It is significant that two U. S. Army aviators, not so long ago, established a photographic altitude record by ascending to 32,200 feet, and taking a photograph of the city of Dayton, Ohio, from a height of six miles, covering an area of nineteen square miles on a single exposure, 7 by 9 inches.

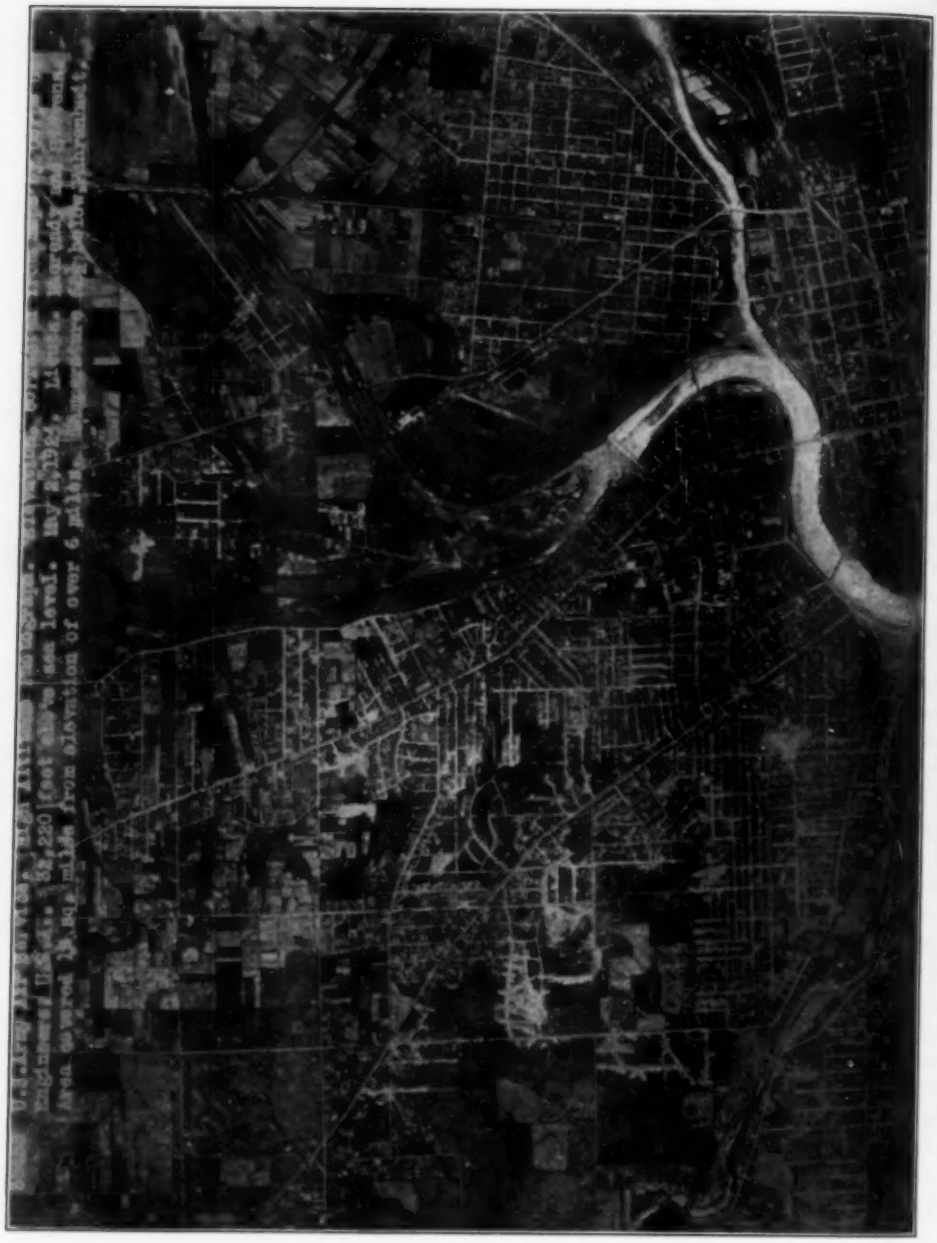
The ultimate possibilities of photographic apparatus, for the mapping of the ground beneath from such altitudes, with the plane—unseen and unheard—haven't even been fully realized. The importance of scientific aerial photography for martial and commercial pursuits will constantly increase, as time goes on, and more rigorous demands are made upon creative genius to supply that demand.

At this stage the future scope of aerial photography cannot even be forecast with any degree of accuracy. Time alone will tell.

Needless to add, such specialized equipment as a modern aerial camera requires special flying equipment, in

TYPICAL INSTALLATION OF FAIRCHILD MILITARY AUTOMATIC AERIAL CAMERA

The camera may be seen in the center, with a spare magazine above it. At the right in the view finder, whilst the intervalometer is mounted above it. Beneath the fuselage appears the propeller-driven dynamo, which supplies current either direct or the motor



U. S. ARMY AIR SERVICE HIGH ALTITUDE PHOTOGRAPH

Shot with Fairchild Military Aerial Camera from a height of 32,820 feet above sea level, May 2, 1924, by Lieuts. Macready and

addition to highly trained personnel, in order to assure satisfactory results. The demand by the services and the public for a high-grade combination of aerial mapping equipment, caused the Fairchild organization to develop a special mapping monoplane, adapted to the requirements of the Fairchild Aerial Camera, thus insuring a harmonious ensemble.

U. S. ARMY AIR SERVICE HIGH ALTITUDE PHOTOGRAPH
Shot with Fairchild Military Aerial Camera from a height of 39,400 feet above sea level, May 2, 1924, by Lieuts. Macready and

Airports and Landing Fields

By William E. Arthur
President, William E. Arthur & Co., Inc.

WITH the steady growth of commercial aeronautics, and the establishment of airways criss-crossing the United States, the necessity for well designed airports becomes apparent. The city without an airport will be in the same class as a coastal city without a well-equipped harbor.

Cities and nations, like individuals, achieve material progress in proportion as they possess pioneering minds and the courage to make plans and follow them through.

The genius of America has been in the ability of its people to sense the trend of development, and to brave temporary inconvenience for the larger benefits towards which they aim. Few of our national undertakings have been able to offer immediate profit, and none of them have failed to be enormously profitable in the end.

In our generation we have seen the automobile emerge from a thing of ridicule to revolutionize land travel and transportation. Perhaps to no other one thing does the South owe its present prominence in national affairs than to this mechanical infant of yesterday.

In this generation, also, another great factor has come into the life of the nations—men have learned to fly.

Urged by influences far greater than behind any other national venture, the airplane hovers over our cities today, asking the hospitality of safe landing fields. Backed by industrial and social need, these ships of the air have not found pioneer spirits lacking to develop and fly them, nor can communities refuse their service, and continue to retain their place in the industrial competition, which is sweeping forward in a test of civic strength and the right of communities to commercial life.

Within the last twelve months commercial aviation has emerged from the obscurity of doubt and uncertainty to a condition of fact which challenges the attention of all. We stand upon the threshold of an era of flying.

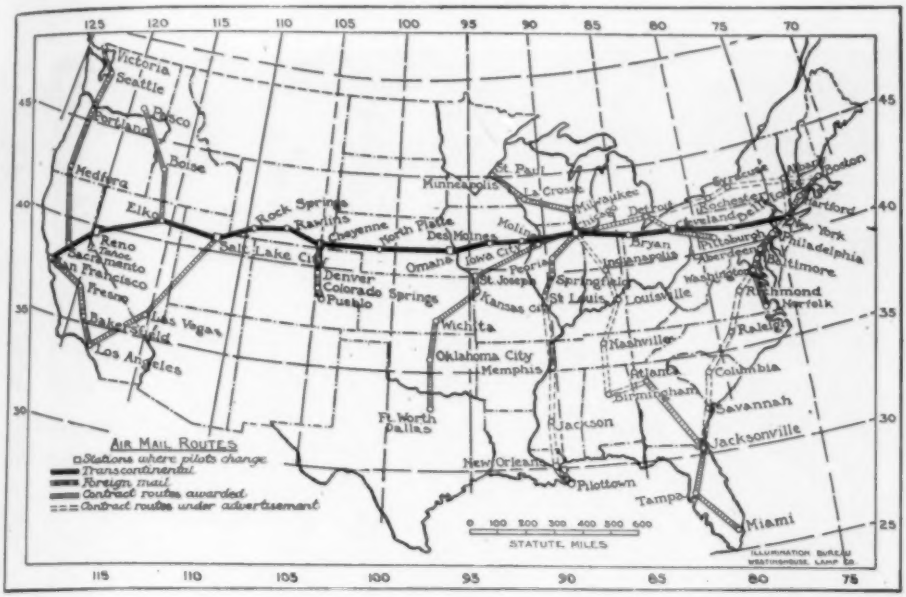
Given some place to start from, some place to go to, and a route over which to fly, an airplane will develop air traffic as well as help develop the cities and communities between which it flies.

Air Lines

Cities throughout the country are rushing to provide airports in which they are making investments of from $15,000 to $1,000,000 and more. These airports, according to governmental plans, will be linked together in a network of lines, criss-crossing the country, and, according to the War Department's published plans, covering a straight-away line of more than 50,000 miles. Air mail lines are taking form, and the pioneer lines, of course, will witness the greater developments, due to the fact that during the further educational period necessary to fully develop public demand, the cities not early providing themselves with airports will find it difficult thereafter to secure the services of air transport companies because of competition with parallel lines.

On May 20, 1926, Congress passed the Air Commerce Act, definitely committing the United States government

THIS MAP SHOWS VARIOUS AIR ROUTES NOW IN OPERATION OR CONTEMPLATED IN THE VERY NEAR FUTURE



MAP OF NEW AND PROPOSED AIR TRANSPORT ROUTES, DECEMBER, 1926

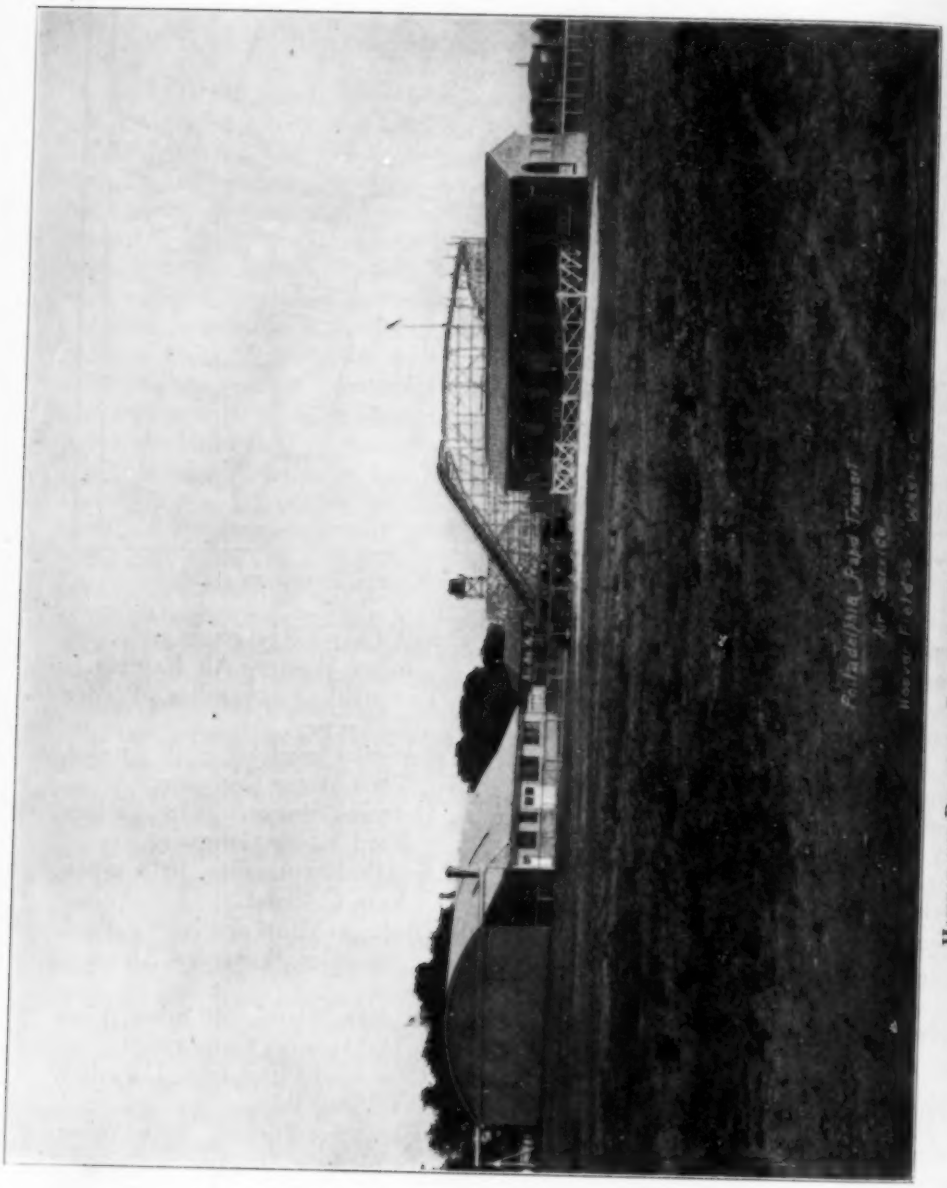
to encouragement of air transport and passenger lines, and setting up a new department within the Department of Commerce, the whole time of which will be devoted to the promotion of airways. Under the auspices of this department, the following seventeen lines are now in operation, with four additional lines to be immediately provided for:

Government:

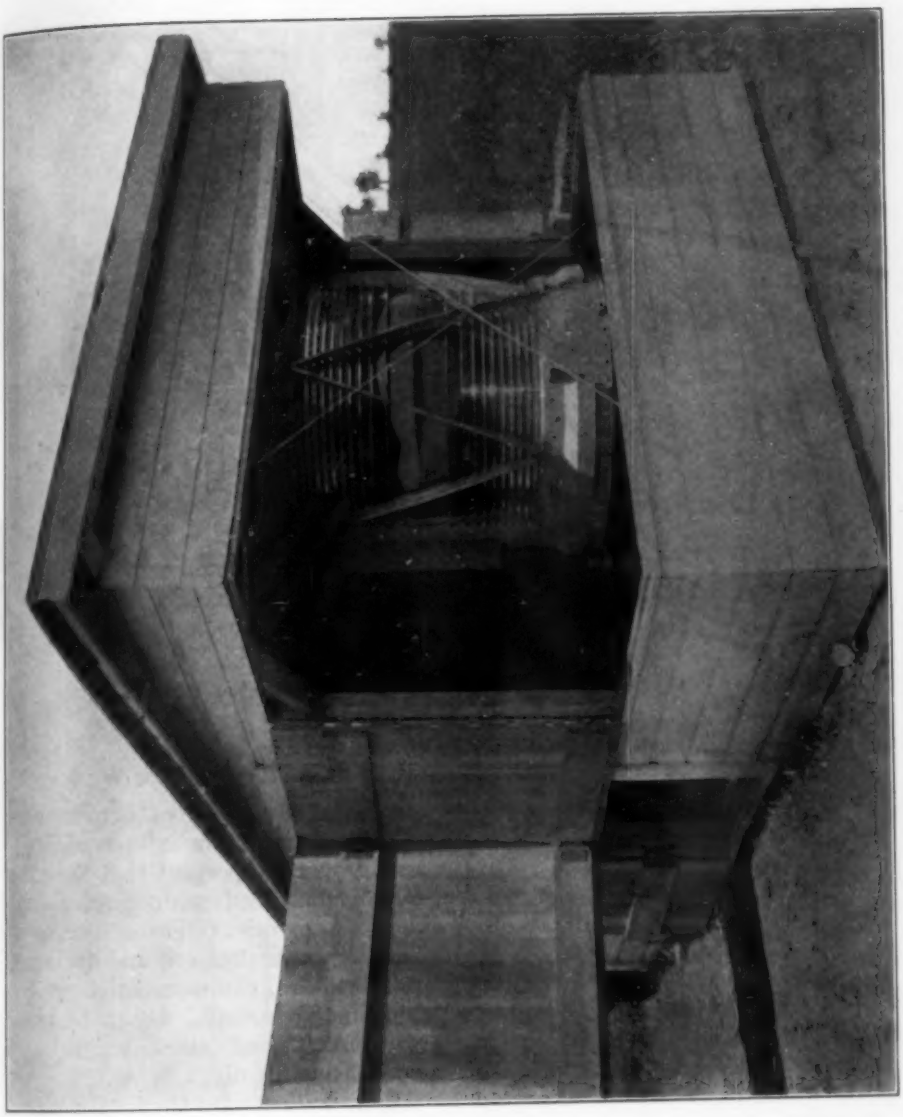
1. Transcontinental, 2665 miles, Post Office Department.
2. New York-Chicago, night mail, 770 miles, Post Office Department.

Private Contract Air Mail:

1. Boston-New York, 220 miles, Colonial Air Transport.
2. Chicago-St. Louis, 277 miles, Robertson Aircraft Corporation.
3. Chicago-Dallas, 995 miles, National Air Transport.
4. Salt Lake City-Los Angeles, 589 miles, Western Air Express.
5. Pasco-Elko, 424 miles, Walter T. Varney.
6. Detroit-Cleveland, 91 miles, Ford Motor Company.
7. Detroit-Chicago, 278 miles, Ford Motor Company.
8. Seattle-Los Angeles, 1073 miles, Vera C. Corst.
9. Chicago-Minneapolis-St. Paul, 384 miles, Northwest Airways, Inc.
10. Atlanta-Miami, 740 miles, Florida Airways Corporation.
11. Cleveland-Pittsburgh, 115 miles, Clifford Ball.
12. Cheyenne-Pueblo, 200 miles, Colorado Airways.
13. Seattle-Victoria, 78 miles, Edward Hubbard.
14. New Orleans-Pilottown, 80 miles, Robertson Aircraft Corporation.



HANGAR AND PASSENGER STATION AT HOOVER FIELD, WASHINGTON, D. C.
Constructed for the Philadelphia Rapid Transit Air Service. This is the first modern air passenger station constructed in the



Flood Light. Type Used for Illuminating Field for Night Landing

Hangar and Passenger Station at Hoover Field, Washington, D. C.
Constructed for the Philadelphia Rapid Transit Air Service. This is the first modern air passenger station constructed in the

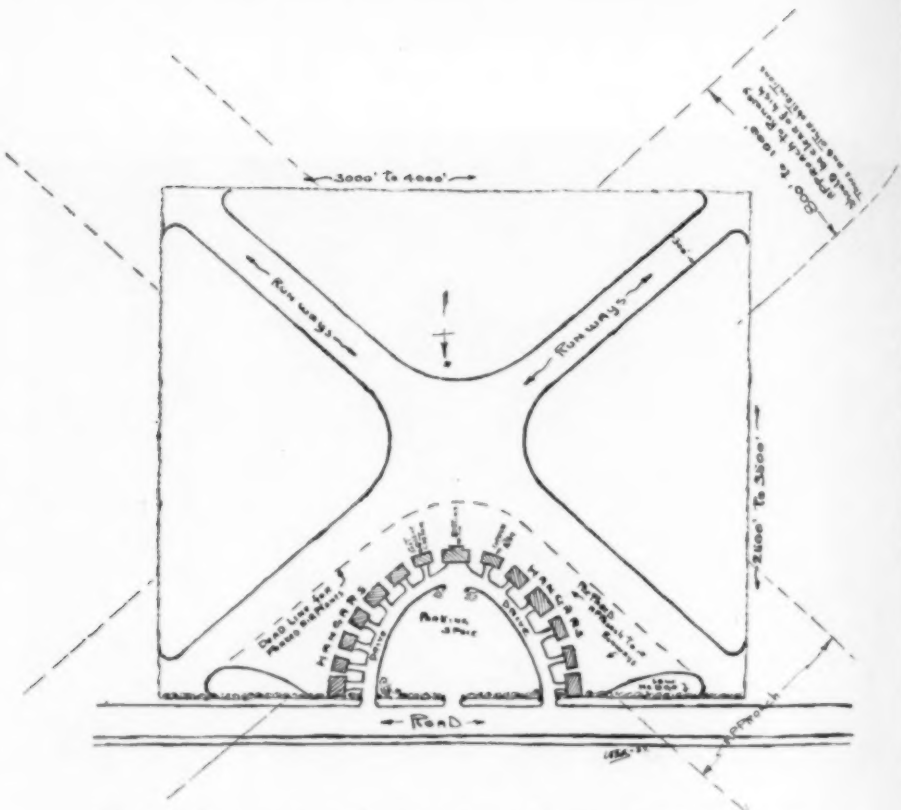


FIGURE 1—DIAGRAM OF A MODERN AIRPORT DESIGNED BY WM. E. ARTHUR

15. Philadelphia-Norfolk, Philadelphia Rapid Transit Air Service.
16. Detroit-Grand Rapids, 140 miles, Stout Air Service.
17. Atlanta-New York, 773 miles, Pitcairn Air Lines.

The government proposes to furnish intermediate landing fields and light beacons between terminals, so as to make possible night flying between airports which the cities are expected to provide. The intermediate fields will be located approximately 20 miles apart; a tremendous lighting program is anticipated, and many other means of assisting the air navigator will be provided by the national government.

SELECTION OF SITE

In the selection of sites there are several important factors to be considered, and it is very important that these be properly balanced with careful consideration to orientation of site, provision for expansion, soil and drainage, transportation, communication (radio, telephone, telegraph, etc.), building arrangement and construction, and field lighting for night flying.

Figure 1 illustrates the ideal modern airport as designed by the writer, which indicates the cross runways of approximately 3000 feet in length, and about 200 feet or more in width, and also shows ideal locating of hangars and other buildings. However, there

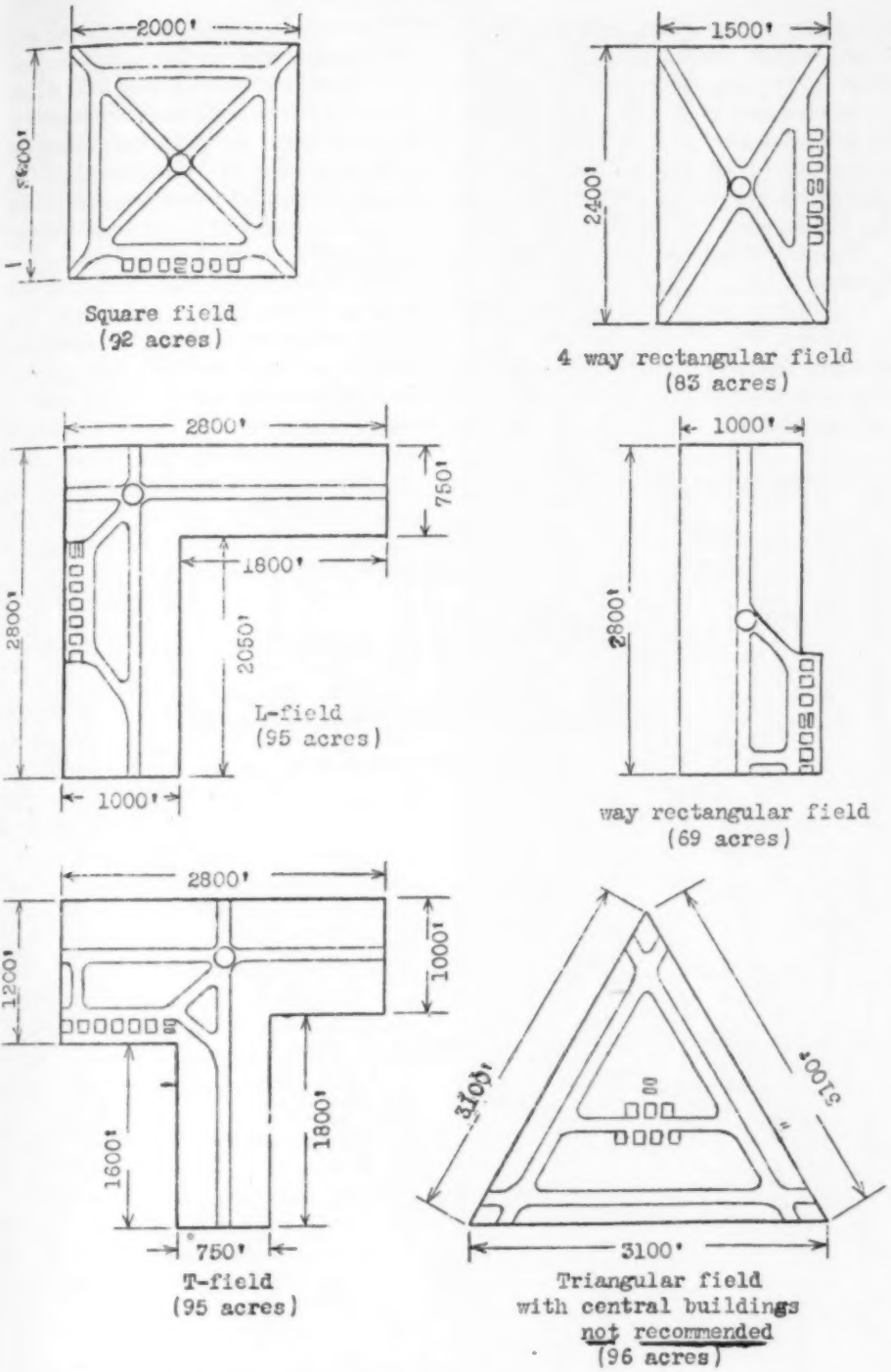


FIGURE 2—TYPES OF LANDING FIELDS WITH 2800' RUNWAYS

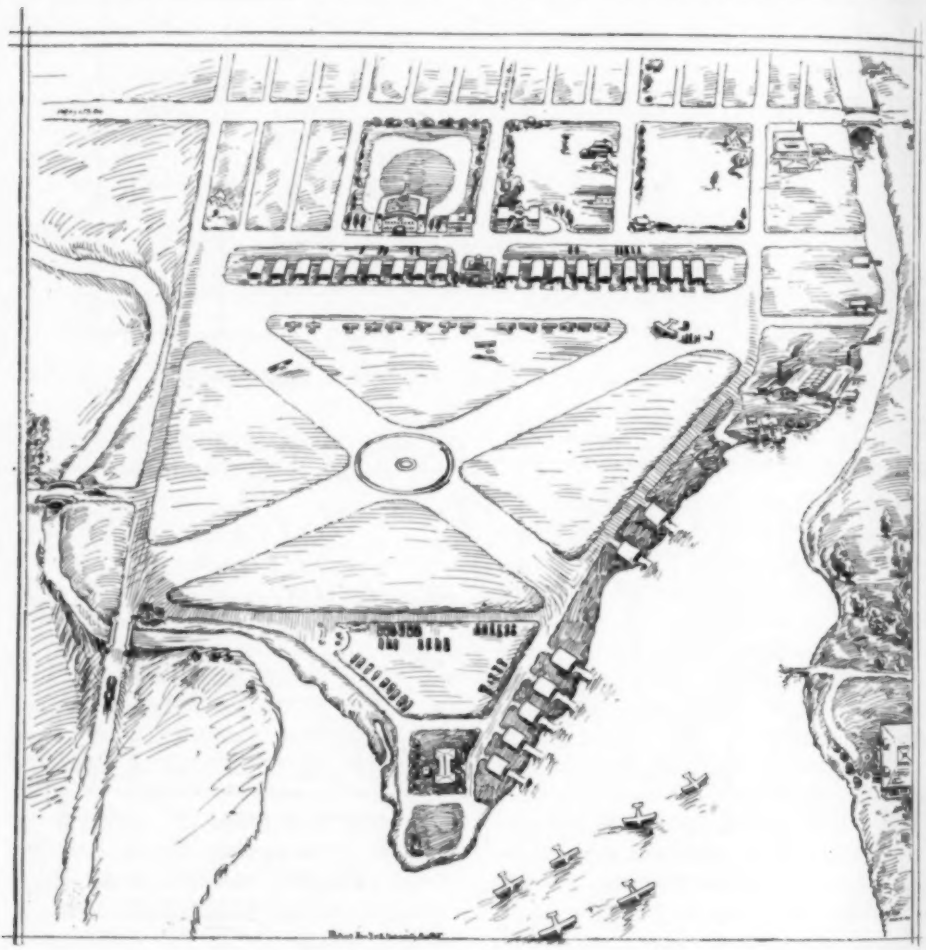
are many cases where a field of this type would be impossible. Where such is the case, the main requirement to be observed is that the field shall be of sufficient size to permit the efficient operation of all types of commercial planes, at the same time anticipating for the future.

Figure 2 illustrates several types of landing fields.

LAYING OUT OF AIRPORT

After the field has been selected, and the direction of the prevailing wind determined, the next step is laying out the runways. The runway, a specially prepared strip for planes to land upon, is a necessity in any field where other than very light traffic is expected. Thick, tough sod will sometimes be sufficient, even in rainy weather, but this must be solid enough to resist three times the weight of planes, the average stress at the moment of landing.

Runways should permit of four-way landing if possible, or the next best combination as indicated. After the layout has been decided, the runways should be constructed, using cinders, slag, or other suitable material, tamped



PROPOSED NEW YORK UNIVERSITY AIRPORT

down sufficiently to present a uniform surface, but not enough to prevent drainage. As previously mentioned, the runways should be as long as possible, not under 3000 feet, and free from obstructions at each end. The minimum satisfactory width should be about 200 feet.

If the field is of sand or gravel, it will drain naturally, otherwise, artificial means must be used, such as ditches flush with the surface. When such ditches are required to drain the runways, they must be filled with stone or coarse gravel to the cinder level, the smaller stones tamped down at the top so that landing gear will pass over smoothly, and yet maintain good drainage.

Every added foot of runway length makes for added safety.

LIGHTING FOR NIGHT FLYING

All airports should be properly lighted in such a way as to indicate location of field to pilots, and flood-lighted to assist in landing and takeoff of planes. Types of this lighting are included in the following:

Beacons that throw sharp long beams of light which revolve in the sky, acting as aerial lighthouses to the pilot.

Boundary markers that are small, sharp, contrasting, and sometimes flashing lights.

Red lights, indicating that there are obstructions and dangers to be avoided, such as telegraph poles, trees, houses, towers, etc.

Green lights indicating approaches to runways.

Buildings on the field flood-lighted to give the pilot a perspective, thus enabling him to judge his height better when approaching the field.

FLOOD-LIGHTING

There are many types of flood-lighting, but the most satisfactory to date

(Copyright) William E. Arthur and Co.

A VERY INTERESTING PHOTOGRAPH OF HADLEY FIELD, THE NEW YORK TERMINAL OF THE U. S. AIR MAIL SERVICE

This photograph was taken by William E. Arthur at 9:45 p.m. on the night of Tuesday, Jan. 12, just as the mail plane was taking off for Cleveland. The flood light just does not appear in the picture, being on the extreme left. The boundary lights are clearly visible. The fact that these are flashing lights is the reason for the one appearing in the left hand portion of the picture being apparently extinguished, while another, the one just behind an automobile in the right hand half of the photograph, appears to be dimly lighted.—Reprinted from February 1, 1926, issue, "*Aviation*."

PHOTO OF AIR MAIL PLANE TAKEN BY ILLUMINATION FROM FLOOD LIGHT

is the type with the large Dioptric lens with a high tensity ark, which throws a light in all directions to the ground in such a way that the entire field is illuminated like day, and in a way that no stray light is inclined upward to blind the pilot in approaching the field.

BUILDINGS

The buildings of an airport should usually consist of:

1. A station to accommodate passengers, waiting room, baggage room, ticket office, telephones, telegraph, wireless station, meteorological station, control room for controlling the movement of ships at the field, etc.

2. Field Post Office and Custom House building.

3. Freight and express building.

4. Necessary hangars for different operating companies on the field, also public hangars to accommodate planes over night, much on the same order as automobiles are stored nights at garages.

Space should also be provided for parking of automobiles and buses which arrive at the field.

Of course the type and number of buildings required depend on the size and activities of an airport.

COST ANALYSIS

With all this talk of airports and their equipment, the cost of airports to the different cities seems to be an important factor.

The following cost data was tabulated recently by the Department of Commerce, Aeronautics Division:

Accurate analysis of airport cost per acre is at present impossible because of the small amount of data and the divergent standard of construction and improvement. Land values vary in different parts of the country, and according to the proximity of the airports to the cities. In some cases the cost of leasing ground has been computed by cities as a maintenance factor. In others no check has been made on maintenance. The unit cost per acre is, therefore, only a rough approximation. However, this is the best information to be had until more airports can be considered.

In the following tabulation are shown the data received from seventeen airports. As these ports are located in widely separated parts of the country it is probable that each case will serve as a basis for calculation for some city similarly situated.

The value given in column 3 is the actual amount paid for the land or the assessed value. The cost of putting into shape, indicated in column 4, has been determined differently by each city, but the improvements represented are briefly discussed in the text following the tabulation, so that a proper undertasnding may be had.

TYPE OF AERIAL LIGHTHOUSE USED ON THE TRANSCONTINENTAL NIGHT ROUTE, WITH 24-INCH REVOLVING BEACON

PHOTO OF AIR MAIL PLANE TAKEN BY ILLUMINATION FROM FLOOD LIGHT

City and Name of Airport	*Acres*	*Value*	*Cost of Putting into Shape*	*Maintenance*	*How Bought*	*Sheds*	*Shops*	*Length of Runways (Feet)*
Phoenix, Ariz.....	160	$36,000	$3,600	.....	By city funds	0	0	2,320
Tucson, Ariz.....	80	$8,000	$6,800	$625	Same	1	..	Square
Los Angeles, Calif...,	80	$110,000	$10,000	.....	Field is city land	2	No. not given	3,500
Hartford, Conn. ...	107	$80,250	.....	$11,500	By city funds	3	Same	Square field
Atlanta, Ga.....	30	.....	$25,000	.....	Leased	0	0	2,500 (Triangular field)
Portland, Me.	54	$20,000	.....	.....	Private Owned	0	1	2,000 east and west
Boston, Mass.....	40	$1,000,000	$50,000	.....	State	4	Military	1,500 in T-form
Battle Creek, Mich.	150	$40,000	.....	Leased at $500 per year	Leased	1	Inhangar	2,200 by 1,100; 2,400 by 1,200
St. Joseph, Mo.....	141	$63,140	$40,400	$3,000	By city funds	1	Same	Four way field
Philadelphia, Pa....	125	$125,000	$15,000	.....	Conversion city ground	2	..	3,600 by 1,800
Pittsburgh, Pa.	40	$36,000	$113,000	.....	By city and country	2	..	.....
Cincinnati, O.	207	$56,050	$25,000	.....	Donated	2	1	Three 6,000 ft.
Cleveland, O.....	700	$1,250,000	.....	$20,000	By bond issue	8	3	4,000 ft. square
Muskogee, Okla....	...	$30,000	$19,500	.....	Leased	1	1	.....
Fort Worth, Tex. ..	175	$131,250	.....	Lease cost $1,250 per yr.	Leased with option	..	..	1,000 by 2,000
Pasco, Wash.....	160	$4,958	$2,560	.....	Leased by county	1	1	3,000 by 1,700; 250 by 1,000
Buffalo, N. Y.....	520	$411,000	$203,000	.....	Bond issue	3	1	Cinder. 100 by 2,000

Phoenix.—The site for the Phoenix Airport was purchased by the city from general funds. It is under direct municipal management, and is open for all planes. The maintenance cost is borne by the city. The field is located seven miles from the city on a paved road, and is in charge of a caretaker. Half of the 160 acre field, not used at present, may be utilized when traffic warrants.

Tucson.—The Davis-Monthan Airport site was purchased by the city from municipal funds. The city leases the port to the Army Corps at one dollar per year. Eighty per cent of the maintenance cost is borne by the city, the remainder by the Army. The city is about to establish a larger field, total acreage 1280, on land leased from the Department of the Interior.

Los Angeles.—The Los Angeles Airport is situated on land controlled by the City Park Board, and is maintained by the organization. Sheds were supplied by the Army Air Corps. The equipment was put in order by the California National Guard, which also assists in maintenance.

Hartford.—Ninety-six acres of the Hartford Municipal Airport site were obtained for aeronautical use by conversion of city property, and nine acres were obtained by purchase. The city has an option on another plot of 434 acres and is negotiating for 16 more. The airport is under direct City management, and all maintenance cost is borne by the city and state.

Atlanta.—The city of Atlanta has acquired 300 acres from a private estate, by means of a five-year lease, with option to purchase at one-half the real value, which option will probably be exercised. Two hard surface roads lead from the field into Atlanta, which is eight miles north.

Portland, Me.—Stroutwater Field is privately owned and operated. The expense of constructing the runway and the shop was borne by pilots and other individuals interested in flying.

Boston.—The site of the Boston Airport, available for sea planes also, is state land. The Army and Navy lease portions but the field is open to all planes, and space is available for lease to private enterprises. The

Federal Government, the state, city and public subscriptions provided money for improvements.

Battle Creek.—The Battle Creek Airport is situated on land leased until 1929 with option of purchase. The maintenance cost is borne by local interests and civic organizations.

St. Joseph, Mo.—The Rosecrans Municipal Air Field is located on land purchased by the city from general funds. The maintenance cost is borne by the city.

Buffalo.—The site of the Buffalo Airport was purchased by the city through issue of bonds. It is directly managed by the air division, Department of Parks and Public Buildings.

Philadelphia.—The site of the Philadelphia Municipal Field was obtained by conversion of city property and condemnation of additional ground. It is managed by a board of control, representing the city, state of Pennsylvania National Guard, and the concessionaire.

Cincinnati.—The land for the Lunken Airport was deeded by Mr. E. H. Lunken, to Lunken Airport, Inc., a Cincinnati corporation. The corporation leases part of the field for Army use at one dollar per year. Lights to aid night landing in emergency have been installed.

Cleveland.—Cleveland Airport is located on land purchased by bond issue, and maintained by the city.

Muskogee.—Hat Box Field is situated on a 60-acre plot, of which 40 acres are leased and 20 acres are used by special agreement. The Army leases and maintains the field, but any licensed pilot may use it under permission from the commandant.

Pittsburgh.—Rodgers Field is located on land jointly owned by the city of Pittsburgh and the county of Allegheny. The Army Air Corps leased it at one dollar per year for training purposes. It is open to the public, as it is a municipal airport, although commanded by an Army officer. Maintenance is by the city and county.

Fort Worth.—The Fort Worth Airport is situated on land leased for four years with an option to purchase. Maintenance is by the city.

City budgets run into many millions of dollars; these millions in turn are collected as taxes from the city's commercial activities and wealth produced by them. Exceptional transportation facilities always balance the budget by rise of taxable values. Conversely, a city cannot sustain itself unless it keeps abreast of the times and grows in commercial importance with the years.

American Air Transport

By Archibald Black

Air Transport Engineer and author of *Transport Aviation*

AIR transport originated with the start of operations of the DELAG airship line, connecting several cities in Germany from 1910 until the start of the World War in 1914. These promising operations were suddenly terminated by the commandeering of the air fleet for military purposes immediately upon the opening of hostilities, and this particular activity has not yet been resumed, mainly through the restrictions placed by the victorious allies upon German airship construction and only recently lifted. While the German operations formed the first scheduled airline and the first application of *airships*, the earliest practical application of the *airplane* to civil transport took place with the origin of the United States Air Mail Service in May, 1918. Shortly after the close of the World War, numerous airplane services were started in all parts of the world, including the United States as well as foreign countries. Most foreign countries at once adopted a policy of subsidizing these services, a practice which has always created opposition in this country and which was consequently not adopted here. As a result of the different policies, foreign air services grew faster than our own for several years, but their growth, being forced has been more artificial and perhaps less healthy.

The American Policy on Subsidies

While foreign nations were content to take civil aeronautics as a suckling babe which required some considerable nursing, we took the position that it must carry itself if it was going to stay. This made for more constructive and healthier growth, but it brought with it slower development, rather unpleasant growing pains, and forced many heroic operators to the wall through the slow growth of traffic. However, such operators as Aeromarine Airways did much to pave the way for the developments which are today following. The continued expansion of the United States Air Mail Service as a government operated route has seldom, if ever, been objected to, even though accompanied by a heavy deficit year after year. It was recognized that this service was greatly speeding up communication, and that it could do much to pave the way for private operations by developing air routes, creating a demand for air mail, and encouraging private operators to enter the field. The Service has always been accepted as a gigantic flying laboratory and it has fulfilled this task excellently. With the placing of scheduled night flying upon a practical basis a few years ago, it became recognized that we were approaching the time for gradual transfer of activities from the Post Office Department to private capital.

Developments of 1926 and 1927

The passage of a federal law, permitting the Postmaster General to contract for carriage of mail by air at higher rates of postage, gave an added push to the natural course of development and spurred on several firms to enter the field. As a result, the year 1926 saw tremendous development in the operation of scheduled air trans-

port activities in the United States, the scale of operations towards the end of that summer exceeding those of any other country in the world. This complete reversal of the conditions of a few years previous is not fully appreciated even yet, as many of the operators have confined their first activities to the carriage of mails. Those accustomed to judge air transport solely by the number of passenger carrying routes, most naturally failed to appreciate the magnitude of American operations when all of our mail routes are included. However, many of the operators who began by carrying only mail are now extending their services to include packages and passengers also. This spring National Air Transport Incorporated begins operation of the first express package airline operated under contract with the American Railway Express, the route running from New York, through Chicago, to Dallas, Texas, and serving not merely the towns actually on this line but many of those placed some distance to one side of it.

EXTENSION OF PASSENGER SERVICES

While only eight operators carried passengers last year, several others are planning to enter this field and the summer of 1927 should see most of the contract air mail routes carrying passengers also. Last year the Philadelphia Rapid Transit Air Services carried 3695 passengers over its Philadelphia-Washington-Norfolk route before the season closed. While this firm has withdrawn from the aviation field, the Philadelphia-Washington portion of its route will be included in the service to be operated from New York through to Atlanta by Pitcairn Aviation Incorporated, of Philadelphia. The Pitcairn firm recently obtained a mail contract and is expected to begin operations in the fall of the year. Colonial Air Transport, headed by General O'Ryan, and now operating between New York and Boston, plans to extend its lines westward and to include passengers as well as mail and packages. The western leg of the Colonial lines is planned via Albany, Schenectady and Buffalo for the purpose of tapping the northern territory to advantage. Hence we are promised not merely one, but actually two routes between New York and Chicago, for National Air Transport is to operate over the Government Air Mail route under its American Railway Express contract, as already mentioned, while the Colonial firm will either connect with the projected Stout Air Services extension or will operate directly through to Chicago also.

SCALE OF AMERICAN OPERATIONS

The most striking feature of our American air routes is in their length, and many of the well-known foreign lines seem insignificant in comparison. Western Air Express, operating daily from Salt Lake City to Los Angeles, covers a 650-mile route; Pacific Air Transport with its service from Seattle to Los Angeles extends almost the entire length of the Pacific Coast, its route totalling some 1121 miles; National Air Transport, with its New York line in operation, will be flying daily over a 1726-mile route. In such figures lies the explanation of our sudden jump into leadership, as the logical measure of operations must be based in some manner upon the mileage flown. While the most accurate basis of comparison would be that of passenger-miles and pound-miles, the kind of information usually available makes it necessary to fall back upon the basis of airplane-miles flown. It may be news to some readers to learn that Edward Hubbard's Seattle-Victoria passenger and mail airline has been run-

ning regularly since October, 1920; that, Ryan Airlines have been operating a daily passenger air service between Los Angeles and San Diego for the last two years without even the aid of a mail contract; that Stout Air Services plan to extend their Detroit-Grand Rapids passenger and mail route from Detroit through to Buffalo this summer, operating over Canadian territory for part of the way. These are merely typical of existing activities and of those which are now being put into effect.

COSTS

Some reference to costs seems in keeping here as this question is so frequently raised. At present air transport costs are admittedly high and the man who uses this method must be willing to pay in some proportion to the added speed which it makes available to him. However, this is a condition which will gradually become modified as increased traffic brings down operating costs, for operating costs in air transport depend just as much upon the volume of traffic as they do with any other form of transport. Indeed, our present scale of operations in the air is so small compared with operations of railroads or steamships, that volume of traffic is by far the most important factor in determining costs. It is just this small volume of traffic, rather than inherent characteristics of aircraft, that make air transport costs high today. The remedy lies in greater use. When air transport becomes as commonly used as other forms of transport the cost of it will be comparable. Perhaps, at some distant date, it may even become cheaper than many other forms of transport, but it is yet too early to make any promises of this kind.

Aspects of Commercial Aviation in the U. S. A.

By George B. Post
Lieutenant (J. G.), Naval Air Reserve

DO you believe that, within the next five years, a fair proportion of the American traveling public will be willing to embark, without undue trepidation, in a comfortably heated and lighted airplane, that will leave New York each evening and arrive in Chicago in time for breakfast the following morning? Probably you do not, and yet it is interesting to consider the proven facts which conservatively predict it, for the searchlight of public interest is focused today on the era of commercial aviation, and this time the background to build upon is safely in hand.

History at a Glance

Langley was ridiculed in September, 1903, for the crash of his flying machine which has since been proven to have been capable of flight. The whole world nodded and solemnly agreed that man had never been meant to fly. People scorned him and he died a failure, only to be granted his well-earned recognition in another decade.

Three months later, on December 17, 1903, the Wright Brothers accomplished the first airplane flight, and during the next few years one would hardly have considered the morning paper complete, if announcement of some new airplane record had not been made.

So had times changed! Perhaps there were now fifteen aviators and as many machines in the whole world, and possibly half of them met with accident or death within a year, yet the Sunday supplement writer could hardly be found who did not tell of the great new age already arrived, where all would fly and airplanes would alight in everyone's yard. Flying, it was true, had come to stay, but commercial aviation, as we envision it now, was far from being accomplished, and the first burst of public enthusiasm was already passed and had changed to a skepticism and waning of general interest.

Progress, however, was made during the next five years. Perhaps the world could now boast of three hundred pilots. Flying exhibits at county fairs were becoming common; airplane meets were always productive of records, and occasional cross-country flights of note were accomplished, but still the public utility of the airplane was as visionary as ever, and flying, as a synonym for suicide, was quite generally accepted!

Then came the war, and airplanes and airships became the talk of the hour. Our Army and Navy looked on for three years without action, but in the next two expanded its force of pilots from a mere handful to over twenty thousand well-trained men. Fighting planes were soon flying one hundred and twenty miles per hour, and bombing planes that weighed four tons flew three hundred miles on carefully planned missions at night.

Aviation in war time, however, is forced at best. New types of planes with hoped-for improvements are rushed to completion with barely a test, while the young and reckless types of men are chosen for pilots, and thoroughly

steeped in wine and reckless flying, on their way to the front. Such methods were needed to win, and under the stimulus came tremendous improvements in military types, and invaluable information on the whys and wherefores of flying. Probably commercial aviation was benefited by it. The war developed a manufacturing industry, and indicated the remarkable feats which were later to be sanely accomplished, but it marched along without regard for accident and human life, and paved the way for the period of comparative stagnation in the United States, which, with three or four shining exceptions, immediately followed.

By 1920 everyone had heard about flying, and hundreds of war-trained pilots and aces bought war surplus planes as they happened to find them, and set out with war-time methods to give the public a ride. It was wonderful publicity for flying, for a first-class tragedy will never be barred from the press, and stunts and crashes with shoestring planes and ill-kept motors provided a generous allowance. The public soon felt they knew all about aviation and knew it first-hand, but the great majority knew full well that they never intended to fly!

In the meantime air lines of substantial size and equipment had developed abroad, backed by generous subsidy and guided by government control. Safety was demanded from the start, with good equipment and strictly commercial pilots, and, after the usual mistakes, the lines that had chosen the proper routes and were soundly managed were soon on a definitely established basis. Their progress has been marked in the past few years, and their record of less casualties per passenger mile than the average American Railroad is well worth bearing in mind.

COMMERCIAL AVIATION STRUGGLES

In the United States, however, we continued to muddle through. No subsidies, of course, which was probably wise, but no laws or control, no landing fields or charted air ways except where public-spirited citizens lent a hand, and nothing whatever to induce real capital and management to enter the field.

Public opinion, of course, means everything in an enterprise of this sort, and a sincere effort at careful flying with good equipment was always faced by the menace of adverse publicity from the gypsy pilot with his gaudily painted and often deceitfully attractive machine. Some of these itinerant flyers were the ablest the game has seen, but no examinations weeded the bad from the good; no inspectors went under the paint and varnish and condemned the planes that were structurally unsound, and the resulting crashes that so regularly occurred would inevitably shake the public's faith in what might be the best run lines in the world.

In spite of a condition which our government and the country as a whole refused to seriously examine or attempt to adjust, a few individuals who saw the need were willing to carry on in the hope of future support. Inglis M. Uppercu was one of the first, and Sherman Fairchild another, while to Assistant Postmaster-General Otto A. Praeger belongs the credit for inducing the Post Office Department to experiment with airplanes for carrying the mail.

Mr. Uppercu's Aeromarine Airways was the first, and for years the only consistently operated passenger air line in the United States using really first-class equipment. Twin-motored long-distance patrol planes of the flying boat type were purchased from

surplus stock of the United States Navy, and converted at the Aeromarine Factory in Keyport, N. J., for passenger use. Each plane carried ten passengers, seated comfortably in an enclosed cabin, besides the crew of two, which consisted of a pilot and deckhand mechanic. The planes could carry their passengers for a flight of two hundred miles at a speed of eighty miles per hour, and by 1922, eight of these planes were being used on a regularly scheduled service. Two trips daily were made between Key West, Fla., and Havana, Cuba, during the winter season; one and one-quarter pleasant hours by air, as compared with the eight-hour run which the cross-channel boats required!

In the spring the fleet of planes were flown up the coast to New York, where each ship was carefully re-conditioned and inspected before continuing its journey north along the Hudson and St. Lawrence Rivers and the Great Lakes to Detroit. From June to October the Aeromarine fleet carried passengers and express on a twice daily ninety-minute run from Detroit to Cleveland, Ohio. It was an excellent service, intelligently and conservatively operated, and was the first outstanding example of what could really be accomplished.

AERIAL PHOTOGRAPHY

In 1921 another phase of commercial aviation was put upon an operating basis. During the war the Fairchild Aerial Camera Corporation had developed an excellent camera for airplane work, and the peace-time public quickly appreciated the value that aerial views possessed. City planning and the study of congested traffic points from aerial photographs was immediately suggested and successfully carried out, for in this way a bird's-eye view of actual conditions could be presented in a manner which could not be approached by any other means at hand. Aerial forestry surveys were accurately made within a fraction of the time and cost that was ordinarily required, and road and power line surveys were conducted with similar dispatch.

The Fairchild Company rapidly developed. Instead of hiring questionable planes from itinerant operators, they soon acquired their own fleet of special photographic machines, manned by skilled pilots who had been particularly trained in the work, and operated on an efficient basis. Their success lay primarily in the sound economics of their plan, for in spite of the fact that the public itself might fear to fly, it admired and had definite use for the pictures the pilots could place in its hands, and the business of airplane photography was definitely established.

THE POST OFFICE DEPARTMENT

During this gloomy period while commercial aviation was struggling along without federal aid or control, the government itself, through its Post Office Department, must be given the credit for gradually constructing one of the most highly developed and efficient air lines the world has ever known. It commenced in the spring of 1918 with an unimpressive experimental air mail service between Washington and New York, a route which is served by one of the best five-hour train services in the United States.

Obviously, the remodeled war planes then in use had little advantage over the trains, in so short a route, when the handicaps of inaccessible out-of-town terminals were counted in. The Washington run was soon discontinued, but it proved a start in paving the way for the wonderful system that has since been developed. Today the Post Office Department runs a daily mail each way between New York and

San Francisco in an average elapsed time of approximately thirty-one hours, flying day and night over mountains and lakes, through storms and fog, and *completing an average of 95 per cent of its trips on schedule throughout the entire year!* The route has been marked with flashing beacons and landing field lights for night flying from New York to Rock Springs, Wyo., since 1925. Each plane carries from five hundred to one thousand pounds of mail or parcels post at an average speed for the entire run of well over one hundred miles per hour, and at a cost of ten cents per one-half ounce wherever carried. It has cut in two the schedule of the fastest transcontinental trains. Contracts with civilian aircraft companies for connections with cities to the north and south of the main line run have recently been made and it is planned shortly to extend the system in the hands of strictly commercial companies over the entire United States.

AIRPLANE DUSTING IN INSECT CONTROL

Early in 1925, another direct and unusually spectacular contribution to commercial aviation took place in the United States, sponsored and directed by the writer and backed by the Huff Daland Company, now known as the Keystone Aircraft Corporation of Bristol, Pa. The problem was that of using airplanes as a means of dusting poisonous insecticides on cotton and other plants for insect control, and seems to have had its earliest inception as far back as 1921 in the hands of the Army Air Service near Dayton, Ohio. Credit for the first serious contribution to the idea, however, is unquestionably due Dr. B. R. Coad, in charge of the Delta Laboratories of the United States Department of Agriculture at Tallulah, La., who commenced actual cotton dusting tests in 1922, with airplanes borrowed from the United States Army Air Service.

A brief outline of the situation will give some idea of the possibilities involved. In the United States alone, it was estimated in 1924, that the boll weevil was destroying an average of $300,000,000 worth of cotton each year. A poisonous dust had already been developed by Dr. Coad in his laboratories, which had been proved capable of controlling the pest, but its effectiveness was directly proportional to the thoroughness and accurate timing of the periods within which it was used, and it had been found that, in the hands of the usual unskilled laborer, it was of little or no avail.

Here was a case where speed was of prime importance. Where success depended upon ability to dust at the proper time in spite of muddy fields or tall rank growths which rendered the ground equipment useless, and where one well-paid and intelligent pilot could do the work which seventy-five negroes with their mules and dusting machines could only haphazardly accomplish.

Dr. Coad was the first to see it, and by 1924 had brought his tests to a point where he knew in a general way the types of planes, and the form of flying technique and equipment required. The writer first became interested in the problem through a visit to the laboratories the previous year, and by the summer of 1924 was prepared to approach the southern farmer on a strictly commercial basis. Two specially constructed Huff Daland Dusters were used in the work and, with the help and support of the United States Department of Agriculture and various state and civic organizations, a series of dusting demonstrations were given which drew the attendance of over 15,000 farmers from all parts of the South.

Late that fall, the first case of scientific airplane dusting under contract was accomplished under the writer's direction, near Greenville, Miss., and by the following spring the organization of the Huff Daland Dusters, Inc., of Monroe, La., had been completed, and sixteen specially built airplane dusters had been placed in the field. Last year over 30,000 acres of cotton were successfully protected by airplane from insect damage, at an expense to the farmer no greater than his own inadequate methods would have cost. *Three hundred to one thousand acres per hour* by airplane, as against *thirty acres per day* by ground machines, dramatically told the story, and it only required the development of a proper business organization to place the work on a paying basis.

THE PIONEERS

Before passing on to the present era, it is necessary to mention one further division in the commercial field, made up of the small manufacturers of two- and three-seated machines, and the pilots who bought these machines and flew them about. They formed a weak and struggling group at the start, for with one or two exceptions the large manufacturers of military types held entirely aloof from commercial activity, in the face of the large quantities of war surplus planes which were dumped on the market at the close of the war. As early as 1920, however, a strictly commercial aircraft manufacturing industry had come into existence, made up of a few individuals who were willing to face the odds, and build planes for business or private use.

Some of these newly built aircraft were worse than the obsolete training types they replaced, and high-pressure salesmen were frequently guilty of selling machines to youngsters who had been given a few hours' instruction in flying in new or war surplus planes, and who immediately went forth with a gilded diploma and the assurance that they could now earn their way in the passenger-carrying game. Accidents from this source were probably the most numerous of all, and aircraft concerns could be named by the score which appeared one year, and crashed with their planes before another rolled by.

Fortunately for aviation, however, there were others who knew what it meant and were able and willing to play the game, and the companies these real pioneers established, together with the government manufacturers who have recently entered the commercial field, comprise the nucleus which stands ready to carry on with the work which is now at hand.

THE PRESENT ERA

So passed the years that followed the war. Loaded with every conceivable handicap, the commercial airplane, by 1925, had nevertheless shown, here and there, what its worth might be, and the public was ready at last to seriously consider the facts and wonder what was the matter. The Army had just completed its globe-girdling flight, and had sent a fighting plane from New York to San Francisco in a single day; while the airplane mail, now firmly established, was reaching the business man of the country and proving its inestimable value. Airplanes once more were holding the public's attention, and fired the imagination with the feats already accomplished. More and more came the call for a definite policy for aeronautics and commercial flying, and in 1926 the issue was suddenly brought to a head in dramatic fashion.

Colonel William Mitchell, formerly Assistant Chief of Air Service of the

United States Army, had made charges in a newspaper article, to the effect that our government's air service was being criminally mismanaged, and the national policy for aeronautics, if it could be said to exist, was desperately in need of a change! Fireworks naturally followed, and General Mitchell was virtually dimissed from the service, but not until the press had been filled for months with airplane facts and figures, and public support of the need for drastic action was clearly established.

President Coolidge, in 1926, named Dwight W. Morrow as chairman of a special investigating committee, while the senate had in the meantime appointed a separate one of its own, and in each case the men who were actually flying and building airplanes were invited to speak their minds. A bitter controversy was inevitable, particularly on the military issue, where it centered about Colonel Mitchell's plan for a unified air service, as opposed to a separate Army and Navy control. Even today it is difficult to express a fair opinion on the many points involved. Suffice to say, however, that the entire subject was thoroughly aired and intelligently studied, and that the long needed action was quickly taken.

Assistant secretaries for aviation were appointed in the Departments of War, Navy, and Commerce, and the industry to a man approved the choices the President had made. From the military standpoint their duties were those of coördination between the two branches of the service, and between the flying and non-flying groups in each department, and with the new building programs and subsequent appropriations which have recently been passed, it is felt that the proper development of our National Defense in the air is well under way.

It was in the field of civil aviation, however, that the most revolutionary changes took place, when, on May 20, the Air Commerce Act of 1926 received the signature of President Coolidge! This act alone was unquestionably the turning point for commercial aviation in the United States, and together with the Kelly Bill, or Air Mail Act, which was signed in February of the preceding year, and the appropriations which placed funds at the Department of Commerce's disposal, it paved the way for the unprecedented developments which are taking place today.

Briefly stated, the Air Commerce Act provides for the examination and licensing of civilian pilots. It provides for the inspection and registration of aircraft used for commercial purposes, and the restriction in the use of aircraft which do not comply with the airworthiness specifications. It provides for the development of airways, the selection and marking of airports and emergency fields, and the lighting of these routes for night flying. The Kelly Bill, moreover, gave authority to the Postmaster-General to contract with commercial aircraft organizations to carry the mail, and made it possible for the department to indicate that it would entirely step out of the field of airplane operation, as soon as the industry had shown it was capable of taking over the transcontinental route which it then controlled.

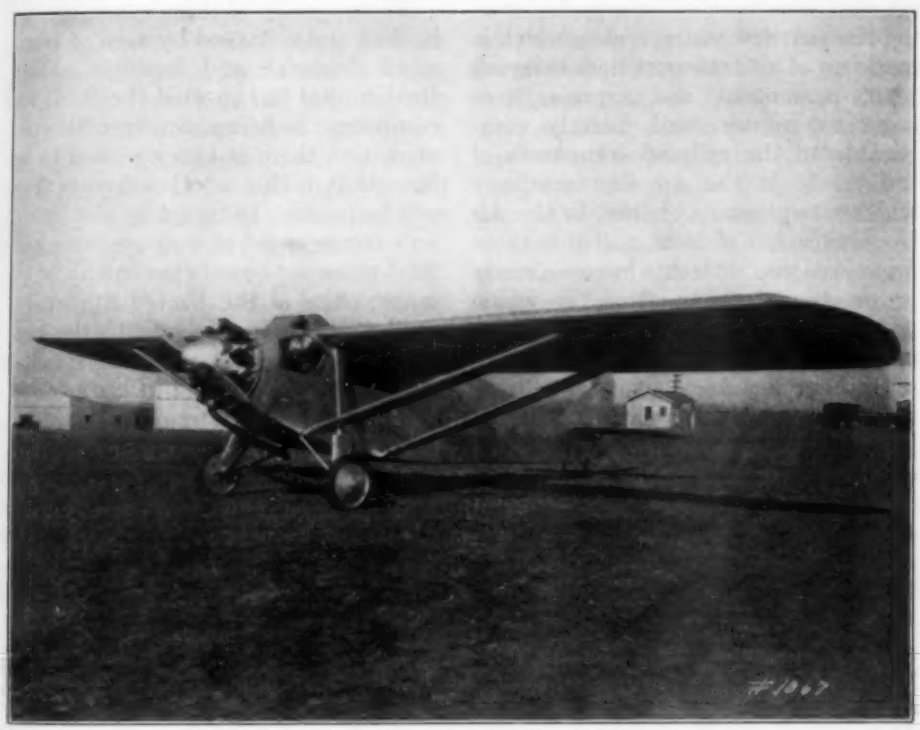
Private capital was quick to grasp the significance of the change. In the contracts for air mail lines, lay definite business which the public had already shown it was ready to support, with the added inducement of passenger and express transportation as soon as developed. Lighting, charting, and preparation of airways was already, or was rapidly being accomplished, while the new laws gave ample protection for the use of first-class equipment and

the public good will which conservative flying develops. The air line problem could at last be placed on a business basis and in the light of these changes, it may be well to review the field as a whole, as it exists today.

CLASSES OF COMMERCIAL AVIATION

For the purpose of comparison it may be convenient to divide commercial aviation into three general classes, made up of the privately owned aircraft for business or pleasure use, the aircraft employed in taxi service and special industrial purposes, and the transport planes which are operated on a schedule basis.

Class one contains by far the greatest number of civil aircraft in use in the United States today. It embraces the youngsters who have bought a new or war-time plane, and fly for the love of the game with the frequent hope of financial rewards in the future; the doctor, the salesman, and the business executive, particularly in the middle west, who have recently put the airplane to more and more widespread use, and the man who owns a plane and who frequently employs a chauffeur for commuting and strictly pleasure purposes. The field can be compared to that of the passenger type of automobile, and may be expected to follow, in general, along similar lines. It was the first to be developed in this country, because individuals here and there could be shown the benefits and induced to buy planes, at a time when the general public was unwilling to fly or invest in airplane projects, but it would seem that at least from the standpoint of capital invested, it will soon be passed by the other two classes.



TRAVEL AIR SINGLE ENGINE TRANSPORT

Class two must obviously include the innumerable applications of commercial aircraft, exclusive of air line use and the privately owned machines, and the examples of agricultural dusting and photography which have already been mentioned are typical of this type. Forest fire patrols, prospecting, and exploration would also be included, as well as the thousands of planes already in daily service, which are available for hire for special trips, a service which the Curtiss Exhibition Company, under the leadership of Casey Jones, has so admirably developed. Aerial taxicabs for quick runs between regular air line terminals and the outlying districts have their definite place in this field, and as the air lines themselves develop, they should rapidly be placed upon an organized basis.

It is in class three, however, that the greatest development is expected during the next few years; a class which is made up of air transport lines carrying mail, passengers, and express, over organized routes, and directly comparable to the railroad companies of today. It is the air line company which was given its chance, in the Air Commerce Act of 1926, and it is these organizations, which have already grown to surprising strength, which will show the public the benefits which travel by air provides.

On February 15, 1926, the first air mail contract route was formally put in operation by the Airplane Division of the Ford Motor Company, with a daily service between Cleveland and Detroit, while on the same day an additional route was inaugurated between Detroit and Chicago. On April 1 the Florida Airways Corporation opened its 468-mile run from Miami to Jacksonville, Fla., which line has since been extended to Atlanta, Ga., while the routes from Chicago to St. Louis by Robertson Aircraft, Inc., from Elco, Nev., to Pasco, Wash., by Walter Varney, and from Salt Lake City, Utah, to Los Angeles, Calif., by Western Air Express, were all in daily operation before the close of the month.

On May 12 the National Air Transport Incorporated opened its 987-mile run from Chicago to Dallas, Texas, with stops at Moline, Ill., St. Joseph and Kansas City, Mo., Wichita, Kans., Okalahoma City, Okla., and Fort Worth, Texas; while on July 1 a route was opened by Colonial Air Transport Incorporated between New York City and Boston, Mass. Other runs, including a service between Seattle, Wash. and Los Angeles, Calif., are soon to be established, and before many years have passed they will be formed together into a network of lines, which will cover the entire country from the Atlantic to the Pacific Coast.

The majority of these companies are backed and managed by men of recognized financial and business ability. Real capital has entered the field; real equipment is being intelligently operated, and there is every reason to believe that within another five years it will be possible to travel by airplane at an average speed of well over one hundred miles per hour between any of the larger cities of the United States, flying by day or by night, with the positive assurance that no greater risk is involved than is found in the present-day travel by train.

As a result of recent developments we understand that even the city of New York has deigned to raise its head from the muddle of subways and other political machinations, and has appointed a committee which is charged with the study of adequate air port facilities, and it is the writer's opinion that the public, at last, is ready to fly, and that the era of commercial aviation in the United States is really at hand.

Lighter-Than-Air Craft

By P. W. Litchfield
President, Goodyear Tire and Rubber Company

RENEWAL of activity by several nations in commercial transportation by lighter-than-air craft which was interrupted in 1914, and of interest in this field, paralleling that in heavier-than-air, marks the beginning of the year 1927.

While this country is somewhat behind as the year opens, some interesting developments are ahead.

Airplanes and Airships Distinguished

Perhaps we should make clear at the outset the distinction between the airplane and the airship. The *airplane* remains aloft through the aero-dynamic forces created by the forward motion created by its motors, plus the lifting effect given by its tilting wings. Being heavier than air the airplane must remain at high speed and at once descends if its motors stop.

The *airship* is actually lighter than the air in which it floats, its motors being used chiefly to carry it forward, and its rudders and control surfaces primarily to give it direction and stability. If its motors fail, the lighter-than-air craft still remains in the air, and will be brought down only by the gradual release of the lifting gas which it contains.

The principles behind the two types of aircraft are widely different; the two are not in competition with each other, the field of each is separate—and parallel. The airplane is faster, but is limited in carrying capacity and endurance. The airship has a much greater cruising radius and carrying capacity, but somewhat less speed.

Because of its size, the airship will never be used commercially for short-distance trips, but will act as a long-distance carrier, particularly between continents and over oceans, with the airplane furnishing the feeder lines coordinating with it.

In the course of development over the past quarter century, both types of aircraft have had many setbacks, and this is one reason, perhaps the chief reason, why the airplane has gone ahead faster in commercial acceptance than the airship.

Because of the lesser cost and the smaller crew, the accidents which have occurred in developing the airplane have attracted comparatively little attention; whereas disasters in the use of the airship, while few in number, have been more spectacular and more costly in loss of life and property, and so have served to create doubts and retard development.

The situation is identical to that of the automobile and the ocean liner. Automobile accidents are of daily occurrence, and the total casualties from this source run into the thousands every year.

A person is safer on board an ocean liner than in an automobile, according to the statistics compiled by the insurance companies, and it is a matter of popular knowledge that disasters to ocean-going ships are comparatively few in number. Yet an accident to a liner is a spectacular thing and its effects are magnified in the public mind as contrasted to automobile accidents.

Faith Undaunted by Disaster

There have been four conspicuous triumphs in lighter-than-air since the

war, which will be referred to later, but these have been minimized by four conspicuous accidents in the same period. The English-built and operated *ZR-11* broke in two during a trial flight near Hull, England, due probably to insufficient internal strength accentuated by incorrect operating; the *Dixmude*, German-built and French-operated, was lost in the Mediterranean due to getting too far away from its base without adequate weather information and with no alternate base to return to; the Italian-built and American-operated *Roma* was forced down due to rudder failure, a mishap which would not have been serious had the ship not collided with a high tension wire and, being inflated with inflammable hydrogen gas, caught fire and was destroyed; the American-built and operated *Shenandoah* broke in two in a great storm.

It is well to face these facts to determine whether the causes of failure are inherent, or so likely to occur as to invalidate the value of the improvement, and if not, to learn how they can be minimized or eliminated.

At least eight nations have indicated their belief that lighter-than-air craft have definite commercial and military possibilities.

England, which began to build rigid airships during the World War and which used the small non-rigid blimps effectively in coast patrol and submarine spotting, is now enlarging its present fleet by two ships nearing completion, planning to use them on a route from England to Malta, to Egypt, to India, to Australia. These ships are to be of 5,000,000 cubic feet gas capacity (hydrogen), or twice the size of the *Los Angeles*. It is estimated they will cut down the distance from England to Egypt from six days to two and one-half; from England to Bombay from fifteen days to five; from England to Australia from twenty-eight days to eleven. These are matters of no small import to the Empire.

United States, which began building and flying the small blimps during the war, built the *Shenandoah* in the government hangar at Lakehurst, acquired the *Los Angeles* as a post-reparations ship from Germany, and had the *RS-1*, a semi-rigid or Italian-type ship, built by Goodyear.

Italy has pinned its faith to the semi-rigid type, and is pursuing an active program of development. It was an Italian ship, the *Norge*, that made the first flight over the top of the world from Spitzbergen to Point Barrow.

Spain, following the example of England in seeking to shorten the lines of communication with customer-nations, has voted a subsidy for a commercial company, which will operate three rigid ships of 5,000,000 cubic feet capacity between Seville and Buenos Aires. One of these ships is scheduled for completion next year at the Zeppelin Company's hangars at Friedrichshafen, Germany.

Japan has bought a semi-rigid of the *Norge* type from Italy, and is now assembling it and has ambitious plans ahead.

Even Soviet Russia is manifesting an interest in airships.

DEVELOPMENT IN GERMANY

In the case of Germany it will be illuminating to include here a brief sketch of the development of lighter-than-air, for it was in Germany that the rigid type originated, and that country has only recently been released from prohibitory rulings of the Inter-Allied Air Council and is now free to resume the operations interrupted by the World War.

Men had learned to ascend into the clouds by utilizing the lifting power of a gas that is lighter than air, as far back as the French Revolution, and in our

American Civil War, Count Zeppelin, a young German army officer on leave, joined the Union army and made flights in an anchored balloon to observe the enemy's position and to direct artillery fire.

It was obvious, that if a balloon could be built large enough to support the weight of a motor and steering apparatus and be shaped to lessen air resistance, it would become dirigible, that is, subject to the direction of its pilot.

Santos Dumont, the brilliant young Brazilian, made spectacular flights with the early dirigibles at the beginning of the present century, and in various countries men were experimenting with metal, fabric, motors, fuels, lifting gas. It was only within the last quarter century, however, with the perfecting of the internal combustion engine, that the project began to become practicable.

Count Zeppelin, who had dreamed of conquering the air ever since he took those flights in Virginia in 1863, resigned his commission in the German army in 1891 to dedicate the rest of his life to this purpose.

In 1908, Zeppelin, then seventy years old, stood discredited and the subject of ridicule. His third successive ship had failed him.

True, it had made a spectacular flight over the Swiss Alps to Lucerne and back, but at the moment of triumph some mechanical trouble occurred compelling a forced landing, and presently the ship was caught up in a storm, carried away and wrecked.

The last of his personal fortune had gone into the ships. The grudging government aid he had received was used up and no more forthcoming. But with indomitable courage the aged inventor appealed to the common people of Germany and within a few months there was raised six million marks by public subscription. It was with this money that Zeppelin built the next ship which was the one to prove his contention.

Thereafter the soundness of the Zeppelin principle was conceded in Germany. By the time of the outbreak of the World War hangars had been established in several cities, passenger airships had carried more than 35,000 passengers without accident or mishap, and Zeppelin was planning a line from Europe to America.

It is probably too early yet to make fair appraisal of the usefulness of the Zeppelin ships during the war, or to speak with any finality of the military value of the rigid airship. But certain facts are available and recognition is growing among experts that whatever vulnerability the hydrogen airship of 1914–1918 had, Zeppelin's ships acted as the eyes of the German fleet, on more than one occasion saving a German fleet from being cut off by surprise attack; that through locating mine areas and directing activities of mine sweepers they helped prevent the submarines being bottled up in their bases; that Zeppelin raids over England retarded the manufacture and shipment of war material; and that the threat of such raids held in England for home defense, a million of men and thousands of guns which otherwise might have turned the tide in France.

After the war the Zeppelin Company built a small passenger airship, the *Bodensee*, which made ninety-eight flights in ninety-one days' operation, operating on a regular schedule between Friedrichshafen on the Swiss border and Berlin, and on two occasions flying up into Sweden. It was just completing a second ship, the *Nordstern*, when the allies shut off further operations.

Most of the military airships at the end of the war had been destroyed by

their crews to prevent their falling into the hands of the allies, but the *Dixmude*, which was just being completed, was finished and turned over to France, the *Bodensee* and *Nordstern* given to France and Italy, and the *Los Angeles* was authorized some time later for the United States.

Realization of the airship possibilities as demonstrated in Germany is one of the factors that has spurred other nations on to take up their development.

The airship can fly faster and farther than any large craft. It can carry larger loads than any fast vehicle. It is independent of land and water, mountains and oceans. Airships have three times crossed the Atlantic.

CONSPICUOUS TRIUMPHS

Indeed there are six flights that stand out, not only as epochal in the development of airship operations but as definitely indicating the potentialities ahead.

In November, 1917, the *L-59* flew from Jambol, Bulgaria, to German East Africa and back on a 4225-mile, non-stop flight, occupying a little less than four days, carrying munitions and medicine for beleaguered colonial troops, being called back before reaching its destination by a radio message that the German force had surrendered.

In 1922 the British *R-24* flew across the Atlantic to Mitchel Field, Long Island, refueled, and returned.

In 1923 the *Dixmude* made a four-day flight and return over the Mediterranean and North Africa.

In 1924 the U. S. S. *Shenandoah* flew 8000 miles around the rim of the American continent.

In the same year, 1924, the *Los Angeles* made a 5100-mile flight from central Europe to Lakehurst, N. J.

And in 1926 came the epochal four-leg flight of the semi-rigid *Norge* from Rome, Italy, to Point Barrow, Alaska, with stops at Pulham, England; Oslo, Norway; Spitzbergen, then over the North Pole, covering 6820 miles.

DIFFICULTIES AND DANGERS

With this background we are ready to consider now what difficulties and dangers the airship has to face and to inquire what steps have been made to alleviate them.

The first of these is the *weather*. Snow and ice have little effect. The doped metalized cover of the Zeppelin-type airship sheds water, and snow blows off as the ship is in flight; or, if moored to the mast and becoming heavy, can take off and in a short flight remove the accumulation.

The *lightning* danger is practically non-existent. Zeppelin ships have been struck with lightning again and again without any more damage than a pinhole where the bolt hit, the metal framework of the ship acting as a "Faraday Cage" in which the charge is dissipated and escapes without harm.

Danger from *storms* is a real one, but this danger, too, can be held at a minimum. Storms travel in easily observable paths and with a concentric motion. Having adequate information as to their course, the airship pilot does not run away from storms but steers for and utilizes them, just as Dr. Hugo Eckener in bringing the *Los Angeles* to America turned abruptly northwest near the Azores, sailed one thousand miles on that course till he caught the outer edge of a storm and swung down past Newfoundland and the Grand Banks with the storm at his back, flying ninety miles an hour with its motors idling.

The *fire* hazard came largely from the presence in the early ships of a gasoline-driven motor and hydrogen gas. Considerable progress in lessening this

risk was made even before the war through better construction and design and personnel control. However, with helium gas, of which America has a monopoly, the fire hazard is practically non-existent. Had the *Roma* been inflated with helium it is quite unlikely that any casualties would have resulted from the ship striking the ground, and it was due to the fact of helium that the only casualties in the *Shenandoah* accident were the men in the control car and one engine car which fell free of the ship.

Incidentally the *Shenandoah* construction followed the earlier-type German ships in having the control car suspended from the ship rather than built into it, as is the case in the *Los Angeles*. This suspended construction represented the effort of early German designers to further minimize the fire hazard due to their being forced to use hydrogen. With built-in cars on the *Shenandoah* there would probably have been no lives lost.

On the matter of engineering failures or faulty construction this should prove no insuperable obstacle, but rather act as a challenge to the engineering genius of America.

DEVELOPMENTS AND IMPROVEMENTS

Airship construction involves the services of the chemist, the metallurgist, the motor builder, the fabric expert, the designer. It calls for calculation of stresses similar to those used in bridge construction but more intricate and complicated. The problem of the airship designer is to build a ship as large as an ocean steamer and yet having the weight of a small channel schooner.

The *Los Angeles* is 656 feet long as against the 900 feet of length of the *Leviathan*, but while the *Leviathan* has a displacement of 60,000 tons, the *Los Angeles* with the maximum lift and load weighs less than 90 tons.

It was the invention of the internal combustion gasoline motor plus the development a few years later of the strong, light metal, duralumin, that made the airship practicable as a commercial carrier, but this problem of weight and strength and the further problem of balance, of adjusting the load in framework, fuel, and materials that is always before the airship designer.

A great deal of progress was made during the war. The speed of airships increased from fifty-five miles to eighty miles. The altitude at which they could fly increased from 5000 feet to 25,000 feet and higher. The carrying capacity and cruising radius was more than doubled.

The 6,500,000 cubic foot ship authorized by the last Congress as replacement to the *Shenandoah* should be able to fly 5000 to 8000 miles with full load without refueling.

The modern airship would utilize the accumulated factors of strength and proved construction developed in twenty-five years of rigid ship building and operating.

These three are probably the most important:

1. The multiple-cover system. One light thin cover whose sole function is to hold the lifting gas; a fireproof and waterproof outer cover to form a fair surface; and a stress-taking metal framework between the two. This arrangement of dividing the functions has the advantage that in case of damage one structural part may temporarily take care of the functions of the other.
2. The multiple-cell system for containing the lifting gas which permits, like the bulkhead system of the steamship, the damage or complete deflation of two or

more cells without danger to the ship.

3. The accessibility of the interior of the ship to inspection and repair even in flight.

There have been important improvements in design. The built-in control car feature utilized in the *Los Angeles* has already been cited; a military airship will have its engine cars as well enclosed within the hull of the ship, with only the propellers projecting on outriggers, thus reducing the air resistance and increasing the speed and efficiency. An airship built now would also have tilting propellers turning in a ninety-degree arc to help force the ship upward or downward as desired.

The perfecting of the mooring mast largely removes the difficulty of taking a ship in and out of the hangar in a cross-hangar wind. Now a ship can tie up to the mast and wait till conditions are favorable.

In fact, in commercial airship operations the ship could operate largely from mooring mast to mooring mast, using the hangar only as a surface ship uses the drydock, or the railroad uses the repair shops, that is for overhaul, inspection, and repair. Passengers and freight would be taken to the top of the mooring mast in elevators and embark directly into the nose of the ship. Refueling and even regassing can be carried on at the mast.

The latest and most important improvement in airship design is the substitution of a triple keel for the former single keel, giving great increase in longitudinal strength, similar to the effect of the breaking strength of three lead pencils tied together as against three single pencils. Associated with this is a new type of transverse girder so sturdily built that each section is self-sustaining, so that the failure of one portion of the ship would not endanger the ship as a whole.

AMERICA'S ADVANTAGES AND DISADVANTAGES

In the race among the various nations for airship supremacy, what are America's advantages and disadvantages?

The *first* advantage is the exclusive possession of the non-inflammable helium gas. Helium is more expensive than hydrogen and has somewhat less lift, so that for operating purposes the 6,500,000 cubic feet ship authorized by the last Congress will be relatively comparable with the 5,000,000 hydrogen ships being built by Great Britain.

It is entirely within the realm of probability that the present defenses against fire hazard will be sufficiently extended shortly so that hydrogen ships will eventually again be used in this country, first for freight and express, and later for all commercial operations, with helium reserved for military use.

However, helium would probably be used at the outset in commercial operations as the supply is abundant, and an increase in production would still further lower helium costs.

The inflammability of hydrogen probably will restrict the field of the military airship so inflated, to long-distance reconnaissance with the fleet, rather than making it an offensive weapon. Because of its speed and cruising radius it has been estimated that for this purpose a single airship can take the place of three surface cruisers, permitting navies to concentrate more money, metal, and men in strictly fighting units.

Plans for military airships contemplate carrying machine guns mounted on top, in the engine cars, in the nose and tail, for defense against airplane attacks, and also for the carrying of three or more fighting planes inside the ship. These can be released and give

battle in a case of unexpected attack, returning afterwards to the airship.

The airship's ability to ascend faster than most airplanes to which it would be opposed, the steadiness of its gun fire as against the fast moving airplane, its ability to lose itself in the clouds, further reduces the vulnerability of the helium-filled airship as a fighting weapon.

A *second* advantage is the mechanical-mindedness and engineering genius in this country. American motors, fabric and duralumin need not take second place to those of any other country in the world.

We must, however, reckon with the fact that construction costs in the United States will be higher, due to the fact that the airship is produced in small quantities, one or two at a time at the most for some time, preventing America from capitalizing its facilities for mass production, which have equalized costs in production of automobiles, airplanes, and other articles.

Airship construction abroad with lower priced labor will undoubtedly start off with smaller overhead. And operating costs, using helium, will be higher than for hydrogen ships.

If the airship, however, can cut in two or even reduce by sixty-five per cent the time now consumed by surface ships in journeys between continents, and is to become a factor in passenger, express, and mail carrying in the future, the matter of equalizing these construction and operating costs becomes a national question comparable to that of the merchant marine.

Several solutions have been suggested, all of them involving legislation. One of the most interesting is that of providing, in case of international traffic by airship between this country and another country, that at least half the traffic must be carried in American-built and owned craft.

The *third* factor in the coming international airship race is the fact that in addition to American industrial power and capacity, and the specialized experience and capacity of American engineers in the government service and in industry, we have in this country the best talent from the Zeppelin organization.

About the time the *Los Angeles* was delivered to the United States Navy by its constructors at Friedrichshafen, the Goodyear Tire & Rubber Company, the largest airship builders in America, having constructed some one hundred non-rigid dirigible ships of various types, took over the American rights from the Zeppelin Company and employed Dr. Karl Arnstein, chief engineer of the Zeppelin corporation and the man responsible for building the last seventy Zeppelin ships.

Dr. Arnstein has been engaged for the last two years, with his staff of a dozen experts, in working out designs for improved American ships based on his experience in Europe. Since airship building is a highly specialized art, this fact is of unusual significance.

At the present time it is the consensus of experts that Europe now definitely holds the lead in airship development, with British and German-Spanish ships scheduled to take the air next year, but the interest shown by the last Congress indicates a definite revival of interest and a determination on the part of this government not to lag behind, or to accept the *Shenandoah* disaster as anything other than a challenge to American engineering and operating genius.

Aerial Globe Trotting

By Captain Leigh Wade
Member United States Air Service and Round-the-World Flyer

SHORTLY after the World War was over, many aviators turned their thoughts towards the practical use of aircraft, and many of them were in the United States Army Air Service. Believing it possible to circumnavigate the globe by an air route, these men began studying the problem, gathering all data, maps, and information they could secure, to await the opportune time to prove to the world that such a feat was possible.

The Preliminary Work

The result was that in 1923 a committee was appointed to select a route and an airplane with a performance and strength to withstand the hard usage it would be exposed to. This being accomplished, the personnel to make the flight was selected, and permission was granted by the War Department in December, 1923, for the demonstration.

Before we start the trip, let us find out about its organization, or the advance preparations. The route was selected and divided into six parts or divisions. An experienced flying officer was put in charge of each to select the landing places, distribute the supplies, arrange for an interpreter, if necessary, billeting, etc. These men are mentioned particularly because of their part in the success of the flight, and the desire of the members of the flight to have everybody know of our appreciation for their work even though they have not been mentioned publicly.

We had new engines, spare parts and tools distributed so well over our route that we could make any repairs or adjustments necessary. All boxes were packed the same whether in Alaska, India, or Greenland. We could find anything in the dark, if necessary. The wood used in crating the supplies was of spruce, the principal wood used in wooden airplane construction, so that when we needed repairs to wooden parts all we had to do was to take a piece from one of the crates.

When the preliminary work was well underway, the personnel selected to do the flying was ordered to Langley Field for a brief course to familiarize ourselves with the type of plane to be used, meteorology, and navigation; then to Santa Monica, California, to supervise the final construction of the planes to be used.

The Start-Off

Now you may ride in the planes with us on a trip around the world. On March 17, 1924, we left Clover Field, Santa Monica, for Seattle, Washington. This part of the trip was to fully test out our planes in order to assure ourselves that nothing had been overlooked. The planes were flown over land as land planes.

At Sandpoint Flying Field, Seattle, the wheels were taken off and pontoons put on to fly to Calcutta, India, as seaplanes. In addition, we checked over our craft very carefully, and arranged all the equipment to be carried. Our personal luggage did not exceed fifteen pounds per person.

On April 6, we departed for Prince Rupert, British Columbia, following the inland passages most of the way. Only a short distance out, we came into

low clouds, thence to fog, snow, rain and frequently strong winds. On arrival at Prince Rupert, it was snowing heavily and Major Martin damaged his plane on landing. Necessary repairs were made while waiting for the weather to clear.

Leaving here, we entered into the hardest part of our journey, because of the meteorological conditions to be encountered. The weather was colder also, which made our work on the planes more difficult.

EXPERIENCES ENCOUNTERED

At Sitka, Alaska, a storm came in on the open side of the harbor, which lasted for two days, The first day, three of the planes dragged anchor and were in danger of colliding before we could reach them. We worked from noon until late in the evening before they were made fast to adequate anchors. The second day, one of the planes broke loose from its mooring. Luckily one member of the flight was aboard who saved the day for all of us. The others were rushing about trying to secure boats to go to the rescue, or were wading out in the water to try and hold the plane from being dashed to pieces on the rocks, for each swell was bringing it nearer and nearer to danger. Just as it was on the crest of a swell, ready to hit the rocks on the next, he managed to get the engine started and pulled the plane out of danger.

The next day we passed by the glacial region but were denied the beautiful scenery by a blinding blizzard. It was just like flying at night; we broke formation, every plane for itself. Fortunately, however, it ended just south of the entrance to the harbor at Cordova. Had the shore line not been straight, we would have piled up on the rocks, or against any projection or island, as we were following the shore line very closely. It was a great relief to arrive at Seward in Resurrection Bay.

It was on our departure from Seward, shortly after passing Kodiak Island, that Major Martin had his second mishap, being forced down near the Indian village of Kanatak on the mainland. The rest of the flight rushed with engines wide open to Chignik Bay to radio for help. He was picked up the following morning by a Navy destroyer, and a new engine was ordered from Dutch Harbor. While the Major was awaiting his new engine, we flew on to Dutch Harbor because of the danger the planes were exposed to by probable storms at Chignik Bay.

On attempting to rejoin the flight, Major Martin crashed into the side of a mountain, completely demolishing his plane, but fortunately not injuring either himself or Sergeant Harvey, his assistant and mechanician. After struggling over the mountains, facing snow blindness, living on meagre emergency rations and wild game for ten days they arrived at Port Moller on the Bering Sea side of the peninsula. Here a boat picked them up and they returned to the States.

During this interval of nearly two weeks, we beached our planes to permit the pontoons to dry out and made any necessary repairs and adjustments to our engines and planes. Then we received orders from Washington to proceed with Lieutenant Lowell Smith in command of the flight.

THE ALEUTIAN ISLANDS

Through the Aleutian Islands we had many things to worry us, such as sudden changes in weather, usually from bad to worse, and peculiar winds called by the natives "woolie wahs." From a perfect calm, a "woolie" would sweep down, often sweeping everything in front of it. The islands are sparsely

inhabited, in most cases of volcanic origin, and without any trees.

Flying along four or five hundred miles, far from civilization, without seeing a human being, only occasionally a few birds, a seal, or whales, makes one lonely. Now and then we would close in our formation for companionship, sometimes with the wing tips almost touching. I can remember as if only yesterday the whole group flying along —Lieutenant Smith leading with the *Chicago;* Lieutenant Leslie P. Arnold in the rear cockpit; the *New Orleans* on the *Chicago's* left, commanded by Lieutenant Eric Nelson, and "Smiling Jack" Harding giving the rest of us all of his smiles; Henry H. Ogden of *Mississippi* with me, wishing for the warmth of our Sunny South. We conversed by hand signals, which we called the "rabbi code."

Many times when we prepared to leave on a leg of our journey, a stiff breeze would be blowing, necessitating one member of each crew lying flat on the pontoon to free us from the mooring. In doing so we would get the spray from waves breaking on the pontoons. Then we would hop in and fly several hundred miles, our flying garments freezing with a coat of ice, which served to keep the heat in next our bodies.

LIVING ACCOMMODATIONS

Our living accommodations in many instances were of considerable contrast to those afforded by our American homes or hotels. We quartered ourselves in traders stores, salmon cannery bunk houses, or on boats with bunks just wide enough so that we had to sleep in one position and which were not long enough to stretch out in. Now it seems like a hard life, but, at the time, it all was as comfortable as one could wish for.

We enjoyed all of it, and many amusing incidents happened. In one place a fisherman, Jack Toner, had a houseboat which was a saviour to us. Working in the open and becoming cold, we would call on him to get warm. When we departed he asked us to write our names on his front door, which he carefully varnished over to preserve. Later, on his return from a fishing trip, he found that someone had stolen his front door for a souvenir.

At one place, living in a bunk house with some fishermen, was a man with a long beard who was heralded as a bear hunter of merit. One's hair would stand on end to listen to him relate one experience after another. On one occasion, while on the beach without any weapons of defense, a huge Kodiak bear surprised him. Dashing madly down the beach, not knowing where or how he was going to escape, a large tree loomed in view. This tree had but one limb which was twenty feet from the ground. Just as he neared the tree and the bear was ready to strike him down, he gave one tremendous leap. All excited, one member inquired, "Did you make it?" The old man replied in a nonchalant manner, "Missed it on the way up, but caught it on the way down."

In the attic of a trader's store, living on everything that ever grew in a tin can, the chief of the Aleutian tribe kept some chickens. One of our members with an ingenious mind fixed the engine of his motor boat, the only one on the island. Having bargained with him for two chickens for making the necessary repairs, we enjoyed a delicious dinner, cooked by ourselves.

At another island we found a population of twenty-six, all the men being absent on fox islands, with the exception of one, "Mike," their chief. "Mike" was very ambitious and many times brought us fish which we certainly enjoyed.

CONTINUING THE FLIGHT ACROSS THE PACIFIC

We had a great problem to complete our flight from Attu Island across the Pacific. The weather never seemed to clear on both ends, that is, at Shimshu of the Kurile group, Japanese territory, and Attu Island. Finally we selected a day, but very shortly on our way we encountered a terrific storm. In attempting to detour around it, we used up our fuel and were forced to take refuge in Soviet territory, on Bering Island of the Komandorski Islands.

Foreseeing such an event, we had sent a boat of the Bureau of Fisheries ahead, taking position just off shore. When they saw us coming in they dashed in and dropped moorings to which we made fast overnight. We received a call from the Soviet Governor General of the Islands on board the boat. Our relations were most amiable but he regretted he could not invite us ashore. Leaving early the next morning, we completed our Pacific flight upon arrival in Japanese territory.

Passing along the Kamshatka peninsula we encountered a very bad storm, which lasted for two days. After leaving our planes to go aboard the U. S. destroyer *Ford*, which with two Japanese destroyers was waiting for us with supplies, we were unable to get near our craft until the following afternoon after the storm calmed down. Then we found the moorings had chafed through and only an emergency rope was holding the planes to the moorings.

By two in the morning we had refilled and were on our way to Yetorfu Island. Such a journey! Ducking from one island to another in fog most of the journey; the only relief was in seeing a few birds taking to the air or sea lions rolling off the jagged rocks into the water as we passed an island.

It seemed like heaven to land at Lake Hittakappu on Yetorfu Island and find green grass, trees, and a large crowd of Japanese in their highly colored costumes. Among them was a group of school children who had hiked overland for three successive days to be there on our arrival.

IN JAPAN

We arrived at Lake Kasumigauru, just outside of Tokyo, ten days after the Japanese exclusion act was passed at home. We were thirty-one days behind schedule and had lots of work to do on our planes, such as changing engines, pontoons, etc. We found the Japanese had planned a two-weeks' welcome for us. Ambassador Woods arranged a condensed schedule, so we left our work and went on a two-day reception, and as warm and sincere a reception as anyone could hope for. Our only complaint was that there were so many meals in one day and that we were not able to eat all the delicious food.

They extended every means possible to make our journey successful and enjoyable all through Japan. When we arrived at Kogoshima, the last stop in Japanese territory, late one afternoon, we received a surprise and thrill. It seemed as though all of Japan was gathered on the beach to welcome us at sunset; and a band from our Navy played our national anthem, while about fifteen thousand school children sang in our own language.

TRAVELING THROUGH CHINA

Our next flight was across the Yellow Sea to Shanghai. It was the first perfect flying day since we started. We were greeted by a great mass of people, and were given a magnificent reception in the evening.

Then and there we decided that we must have relays for receptions. We

had only our heavy uniforms and we were in the tropics. So afterwards we took turns in borrowing a light suit from someone aboard a boat and going to the receptions.

The method used in propelling boats worried us. In sculling a boat by a long oar around our pontoons, the sides of which were made of a thin veneer, we feared a puncture and delay. As it was we had difficulty enough arising from the water with heavy loads. Therefore, all through the tropics, we sent a boat on ahead with fuel aboard so we could land alongside or near it, to take on the needed supplies.

Leaving Shanghai, we followed the coast line to Amoy, and on to Hongkong. It was amusing to see the native fishing boats away out to sea, propelled only by man power. Sometimes we came so near them that they scrambled all over the boats in fright.

From Hongkong to Hoiphong, French Indo China, we passed over a group of islands that rival, if not surpass, our Thousand Islands in beauty. Some were mere rocks of varied colors, while others were covered with a jungle forest. We were pleased to have clear weather for a fog or storm undoubtedly would have meant disaster as the Islands were so close together and numerous.

On the next leg of our journey one of the planes was forced down in a lagoon near the shore just east of Hué. The others landed. A new engine was necessary, so on we went to Touraine to order a new one from Saigon. While the new engine was en route, the disabled plane was towed up the river to Hué by native sampans, a subchief in each beating a tom-tom for cadence while their families and hundreds of natives trailed behind in boats. The new engine was trucked over a jungle trail at night to Touraine, was in the plane running in just seventy hours from the forced landing, and on its way to Touraine to join the other two planes. The rapidity with which the repairs were made is explanatory of the work of the organization which planned our trip.

OVER THE MALAY PENINSULA

Thence on to Saigon and to Siam, landing in the river at Bangkok. Thinking we were going to be with them for some time, the natives were surprised when informed we were stopping only for one day. However, they wanted to pay a proper tribute and on the eve before our departure invited us to a beheading of two prisoners. We certainly appreciated that hospitality.

Our next flight took us directly over the Malay peninsula to Burma. It was all very wild country, parts of which were inhabited by an ancient race of pigmies, who still hunt with blowpipe and poisoned dart. On arrival at Burma we found a storm from the Bay of Bengal had blown in and clouds covered the mountain tops. We had a great time picking our way through. One plane was caught in a down current of air and barely escaped crashing in the jungle. It rained until we got to Rangoon, where we remained several days because of repairs to one of the planes, damaged by a native junk boat during the night.

We flew through rain most of the remainder of the way to Calcutta, via Akyab and Chittagong. At Calcutta we changed engines and put wheels on in place of pontoons to fly overland to England. As a rainy season was due, we shipped our engines by rail to Karachi and worked night and day in order to depart as soon as possible. We took off from Maidan Park, in the center of the city, on July first.

THE JOURNEY ACROSS INDIA

Our journey across India took us to Allahabad, past the beautiful city of Delhi, on to Ambala; thence across the Sind Desert, where we encountered a sand storm for nearly five hours before our arrival at Multan. We were coated inside and out with sand. The heat was terrific. We were told it was one hundred and twenty-eight degrees on our arrival, which we had no cause to doubt.

July fourth, en route to Karachi, the *New Orleans* had engine trouble eighty-five miles out, due to a valve breaking. Lieutenant Nelson demonstrated his skill as he nursed it on in to the airdrome. Here we put in our new engines and left India behind as we carried on along the Persian Gulf, at times passing over saw-toothed mountains which were so barren that I doubt if even cactus could grow. We stopped at Cha Bar, Bandar Abbas, Bushire, thence over Basra and on to Bagdad.

We were so anxious to leave the tropics and get home that even though we were near some of the wonders of the world, we did not deviate from our course, only stopping overnight at the Royal Flying Corps Airdrome near Bagdad and thence on to Allepo, Syria.

IN CONSTANTINOPLE

Our next flight was exciting as we took on sufficient fuel to fly direct to Constantinople. With this heavy load we were forced to wind our way through the Taurus Mountain following a trail. Often we were completely surrounded by mountain peaks and the passages so narrow that we were forced to go through single file. Over the high plateau, passing extinct volcanic craters, past Konia and suddenly a beautiful city, Constantinople, came into view, with the blue Bosphorous, its great wall and many mosques.

ACROSS EUROPE TO PARIS

After two nights and one day we departed for Bucharest, Roumania, where we spent one night, and continued across Europe over the Franco-Roumanian air route, passing Belgrade, on north to Budapest for lunch and to Vienna. We stayed overnight and then hurried on to Paris via Strassbourg.

As we were thirty-one days behind schedule at Tokyo we decided to work extra hard and to make up the lost time so we could take a one-day holiday in Paris. We arrived on the fourteenth day of July, having picked up seventeen days. Our holiday consisted of placing a wreath upon the Unknown Soldier's grave, a luncheon, a reception at the Hotel de Ville and by the President at his home, followed by a dinner at the Allies Club. On our first eve, there being nothing official planned, a group entertained us at the Follies Bergére. Upon arrival and being comfortably seated, we all went to sleep, which resulted in comments by the papers next day that if such would not keep us awake, what would?

THE ATLANTIC FLIGHT

July sixteenth found us on our way to Croydon, England, thence to Brough on the Humber on the seventeenth. Here we had to prepare for the Atlantic flight, putting pontoons on in place of wheels, new engines and whatever other work was necessary. We had ample time as our supplies had not been fully distributed across the Atlantic.

Our first flight then was to Scapa Flow, where we came in contact with our Navy again, which was to escort us across and render invaluable assistance.

On the first attempt to reach Iceland we encountered fog, and, in attempting to go over it, we were forced to break formation. The *New Orleans* was hit by the propellor wash of one of the other planes and sent down in a tail spin but recovered control just over the water and continued on. The *Chicago* and *Boston* returned to Kirkwall to give out a message of the approximate location of the *New Orleans*. After many hours of suspense we received a message of its safe arrival at Angamasalik, Iceland.

The next day, half way to the Faroe Islands, my plane, the *Boston*, was forced down due to engine failure. We signalled to the crew of the *Chicago* not to land but to send assistance. They continued on and dropped a message to the U. S. S. *Bellingsby*. This news was radioed to the other boats which came to my rescue. Nearly five hours after landing on the sea we were taken in tow by an English trawler. The sea was getting heavier and as we rode over the swells, it nearly pulled our plane apart. So it was a relief when the *Billingsby* relieved the trawler, and towed us a brief time, when they turned us over to the light cruiser *Richmond*, on which we hoped to store the plane. However, in the rough sea it was impossible, especially after the boom dropped, damaging the plane and making it necessary to try to tow it to shore in the Faroes. In this attempt the *Boston* was lost, sinking the next morning.

In the meantime the *Chicago* and *New Orleans* took off for Reykjavik on the west coast of Iceland. There they prepared for the crossing to Greenland. On account of delay, we all became familiar with the city which was a surprise to us all, having a population of over twenty-two thousand, paved streets, electric lights, everything modern, even to taxicabs.

A Jump of Eight Hundred and Fifty Miles

A naval aviator, Commander Leighton, and myself flew in and looked over the harbor at Angmasalik, Greenland, and after considerable thought it was decided to fly direct to Friedrichsdahl, a distance of eight hundred and fifty miles.

It was on this flight that many exciting things happened. As they neared Greenland, a dense fog was encountered. Signor Locantello, the Italian aviator, started with them. When he came into the fog, he turned back out of it, and landed at sea. He was rescued five days later by the U. S. S. *Richmond*.

Fog and Icebergs

When the others met the fog, they realized that the sea was too rough for them to land, and that they did not have sufficient fuel to return to Iceland, so went on. They remained low over the water and about eighty miles out encountered floe ice, then icebergs, with which they played tag. Flying side by side, swerving from one side to another to miss an iceberg, now and then jumping over them, one came in view too suddenly to turn. This one was so huge that one plane went one way and the other in the opposite direction. Lieutenant Nelson in the *New Orleans* made a circle to permit Lieutenant Smith in the *Chicago* to go on and prevent a collision. Traveling at about ninety miles per hour and the visibility about three hundred feet, they kept on keen edge every moment. As they neared and rounded Cape Farewell they came out of the fog only to find another bank at Friedrichsdahl. Locating the harbor by mountain formations, they found a rift in the fog, Nelson arriving thirty-five minutes after Smith. That evening was celebrated aboard a Danish revenue cutter.

On to Ivigtut and across the Newfoundland, down the coast to Picton, Nova Scotia, where Ogden and I rejoined them with the *Boston II*. Thence down the Maine coast, where we were worn out dodging fishing boats, small islands and buoys, in the worst fog we had found anywhere. We finally took refuge at Mere Point, Casco Bay.

ARRIVAL AT BOSTON

The next day we arrived at Boston Airport. During our trip we were totally ignorant of the enthusiasm here in the States, but readily realized it upon finding a huge crowd there to greet us, in addition to the Army and Navy officials.

Leaving our pontoons for wheels we flew overland to the end of the trip. Everywhere we found the same enthusiasm. New York, Washington, D. C., where President Coolidge waited several hours with his entire cabinet in a drizzling rain, Dayton, Ohio, Chicago, and all, on every stop to Seattle. We found it necessary to post policemen outside our doors to prevent souvenir hunters from stealing our clothes. As we were pushed through crowds, people reached over, putting their fingers lightly on us and shouting, "Ah! I touched one."

THE END OF THE JOURNEY

Receptions everywhere, we answered questions it seemed by the millions. Another surprise awaited us at the end—a monument erected in our honor.

We were one hundred and seventy-five days en route, making a total of seventy-five flights on sixty-four days of flying. Our total flying time was three hundred and seventy-five hours.

Our demonstration already has realized a benefit, in my belief, as it has caused many new air routes to be opened and put to use, principally abroad, however. It is quite a satisfaction to repeat the words of an address of welcome given to us on the completion: "In the future many flags will be represented as airplanes fly around the world, but only one nation can claim the honor of having her flag carried around the globe by air first, and that is the United States of America."

The First Trans-Atlantic Flight

By Lieutenant Walter Hinton
Pilot on the *NC-4*, the First Plane to Cross the Atlantic

ADMIRAL TAYLOR'S suggestion of August 25, 1917, called for a machine able to fly across the Atlantic. The idea of such a crossing had never lapsed during the preliminary months of design and construction, which preceded the first flight of the *NC-1* on October 4, 1918. Now, in December, 1918, it revived with fresh intensity.

"If there is to be no fight, there will at least be a flight."

Such, in effect, was Navy sentiment. For already, with the beginning of winter, Navy officials laid their plans for an attempt to fly to Europe to take place early in May of 1919. Route, seaplanes, commanders, fuel, and auxiliary service were carefully discussed in Washington, long before the "Daily Mail," across the water, had made an offer of £10,000, which was to send half a dozen British machines to Newfoundland to select their fields and build their hangars in the fog and melting snow.

The American Navy could not well have hesitated between the two possible methods of crossing the Atlantic. One way, the world knows, was to make the flight a great sporting event. The other possibility was to keep it, as closely as possible, to a well-organized scientific expedition.

Obviously the American Navy could not, even if it would, choose sport in preference to science. Dignity and efficiency forbade that. Its pilots were sent out, not on their own initiative, but by official order and under official endorsement.

Eastward Ho!

From Far Rockaway, L. I., to Trepassey, Newfoundland, is a distance of approximately 1000 nautical or 1150 statute miles.

Three *NC* planes had all covered this distance by May 15, the *NC-4* arriving six days after the *NC-1* and the *NC-3*. Engine trouble had made it advisable for her to descend near Cape Cod. She alighted on the open sea, taxied for eighteen hours, and brought herself, as efficiently as if water and not air had been her natural medium, to the Naval Air Station at Chatham. By May 10 she was ready to resume flight. Favorable weather at 11.17 A.M. on May 14 found her receiving a message from Assistant Secretary of the Navy Roosevelt: "What is your position? All keenly interested in your progress. Good luck!" And replying three minutes later, "Thank you for good wishes. *NC-4* is 20 miles southwest of Seal Island, making 85 miles per hour."

Conditions at Trepassey not having been propitious for flight, the *NC-1* and the *NC-3* had been delayed there since their arrival on the evening of the 9th. When the *NC-4* arrived she was immediately overhauled. A new engine was installed, three new propellers were attached, and a general overhauling given the seaplane. On May 16, 1919, all three boats were ready to start. They had fulfilled almost to the letter the suggestion of their April 14th orders that they take advantage of the May 14th moon.

The *NC* crews prepared for flight, slipping their air togs over Naval Aviation uniforms. They wore a combination of silk socks under woolen ones, and fur-lined boots and hoods, but used no electrically heated suits.

Trepassey had poured out her population, native and transient, to witness the departure. The town was as empty as an inverted pitcher. Shore and water were darkened with spectators. On the destroyers were crowded Naval officers, sailors, and newspaper correspondents.

Now they waited the word. "Let's go!" shouted Commander Towers. The motors of the *NC-3* began to revolve. In the bright sunlight—it was six o'clock New York time—the three vessels taxied out, maneuvered a few minutes, and then, the *NC-3* in the lead, shot forward for flight. They left at 6.06, 6.07 and 6.09 P.M., the *NC-1* bringing up the rear.

The course was the open sea. There were no rivers or railroads or coastlines to follow, no towns or lakes to identify. Only a line of sixty destroyers, clicking advice and brandishing stiff antennae of light, would break the empty sweep of that sea.

In the late light of those first hours the water lay smooth. The deflected glow of a sunset filled the sky. Icebergs swam by under the wings of the flyers.

WITH THE *NC-4*, SIX HUNDRED FEET ABOVE THE SEA

Let us imagine ourselves in the pilot's cockpit of the *NC-4* as she takes her way eastward six hundred feet above the sea.

The fading light shows us the *NC-3* ahead, rising and falling in the changing air as if on the slow, high waves of an invisible sea. All sound is merged into the roar of four motors. All about us is a sense of space, open, illimitable, so vast that we seem shaken free forever from the earth, and winging in a new world whose laws are alien to all we have known.

Before us is the board of instruments, clocks, compass, oil and water meters, altimeter, tachometer, inclinometer. Below us and to the rear works the wireless operator. Far back in the hull, under the wings, are the mechanicians.

The planes fly on through a growing darkness. The *NC-3* disappears. We have switched on our lights, and send a message to her asking that she turn on hers. No response. Something seems to be wrong. We look back for the *NC-1*. Never distinct, she, too, has disappeared. We are alone, with 1185 nautical miles still to go.

The sky is now dark, utterly dark save for stars. These and the line of ocean where the stars cease give the pilot his only means of orientation. The engines labor on. Each of the twelve exhaust ports, unmuffled, sends out its jet of flame as the burnt gas is expelled. In the vastness and invisibility of the time and place those red tongues, each proclaiming the adequacy of its cylinder eight hundred and fifty times a minute, are marvellously reassuring.

Now ahead of us, a swift, narrow stem of flame runs up the sky, bursts into flower, and scatters luminous petals across the night. The star shell of a destroyer! In a minute gemlike lights gleam below, and an illumined vessel tells her number and gives us our location. Check her off the chart!

The plane, winging her way at a thousand-foot elevation now, catches on wing and motor gleams of silver thrown from the east. An edge of moon has appeared. Soon the whole disc has arisen, flooding the world with pale beauty. The pilot, visibility increased ten-fold, relaxes with a sigh. To the south, however, a close surprising shape brings him back to tenseness with a jerk. Another plane flies close, too close for comfort. The *NC-4* veers aside from the friendly but dangerous

shape, and is soon alone once more. Probably she has passed the *NC-3*.

So we ride until the day dawns faintly. The story for the three boats is the same. Everything has gone well. The destroyers have been checked off as regularly as railroad stations; the motors have functioned as faithfully as if they reposed on test blocks; the pilots have relieved one another every half or three quarters of an hour. Toward morning there have been sandwiches and coffee, welcome after the long cold nervous time of comparative inaction.

UNCERTAINTY AND DIFFICULTY

Now, however, was to come a period of difficulty.

The *NC-4*, says her commander's record, passed destroyer *No. 15* before trouble began. Ahead of this vessel appeared what seemed an area of rain, but proved to be fog, driving in the same direction as the *NC* herself. Picking up destroyer *No. 16* in spite of poor visibility, the *NC-4* missed *No. 17*, and for a time flew confusedly. The boat seemed to be making a steep bank, the compass whirling aimlessly about, and visibility merging into a gray blanket of moisture. Finally, however, she merged from the fog, and flying at 3000 feet in sunshine and blue sky, seemed to have outwinged her difficulties, though a white plateau of billowing vapor below showed that the surface of the ocean was still shrouded in mist. Clouds and fog soon appeared above as well as below, and the *NC-4* sent inquiries as to surface conditions. Destroyers *No. 19* and *No. 20* reported discouragingly, but *No. 21* announced that there was a ten-mile visibility, and the flying boat descended. Flying low, her commander soon saw what he thought to be tide waves. Suddenly, above one of these waves appeared a dim line of rocks. They had found Flores! Delightedly they skirted the coast.

Elated, reassured, the crew thrilled with revived hopes. There was sufficient oil and gas left to make Ponta Delgada. Why stop at Horta then?

Their jubilation was brief. Dense fog closed in again. They missed destroyer *No. 23*. "No Ponta Delgada for us today; any port would look good."

They had begun calculations as to the course necessary to find land, when a hole in the fog disclosed the northern sweep of Fayal Island. Horta, to the south, must be just around an aerial corner! The plane flew down the coast, and, pitching through rough air which "tumbled down from a mountain," made a landing in what they hoped was Horta Harbor. They were soon convinced that it was not. No matter! Rising again, they caught a glimpse of the U. S. S. *Columbia*, visible between gusts of obliterating fog. In a moment they had reached her, and swept down at the end of fifteen hours and thirteen minutes to the completion of the first and most difficult stage of the great crossing.

"We passed," says Commander H. C. Richardson, one of the *NC-3* pilots, "through five hours of rain squalls and fog, so thick at times as to make it impossible to see the horizon or the surface of the ocean."

After this experience, with fifteen and a half hours of travel behind her, the *NC-3* was contemplating a landing forty-five miles southeast of Fayal. The *NC-1*, last of the three to start, held her original position with reference to the others.

"We did not meet any trouble," says Lieutenant-Commander P. N. L. Bellinger, U. S. N., "until we got into the fog at 11.10 A.M. (Greenwich time), Saturday, when we were near Station 18."

Once in the fog, the *NC-1* lost her bearings and decided to alight. She did so at 1.10 P.M. She was then about one hundred miles west of Flores. The position of the *NC-3* almost two hours earlier has been noted. Both vessels were at the gates of the Azores. Their motors were in perfect condition. They had adequate supplies of fuel for several hours further flight. Fog alone prevented them from reaching Fayal, or even Ponta Delgada.

In landing, however, both boats found the ocean heavier than they expected. They sustained damage from high waves which made the resumption of flight impossible, even if a take-off on such a heavy sea could have been managed. The *NC-1*, after taxying on the surface for five hours, was discovered shortly after 6 P.M. (Greenwich time), by the *Ionia*. At 6.20 P.M. the *Ionia's* boat took off the crew. An attempt was made to tow the seaplane, but the line broke, and after a time the first Navy-Curtiss flying boat disappeared beneath the waves.

Meanwhile, the twelve-foot sea on which the *NC-3* came down, damaged hull, struts, and control connections. It was apparent that she could not take the air again. Her radio system, though allowing her to receive messages, could not effectively send them. Though the crew fixed her position as forty-five miles southwest of Horta, the wind forbade an attempt to taxi in the known direction of Fayal. The only possible course seemed one with the wind, *i.e.*, eastward, which, it was calculated, would carry the *NC-3* to San Miguel.

Night came, and the boat was buffeted by wave and rain. One of the elevators, badly damaged, had to be cut loose. The crew took turns steering, those off duty attempting to sleep. With morning, in the twenty-second hour of surface riding, the left wing tip was washed away. One of the crew crawled out on the right wing and clung there, deluged occasionally by waves, to keep the left wing from being submerged. Radio messages were received telling of the rescue of the *NC-1* crew, but also disclosing to the *NC-3* that those who were searching for her were looking west instead of south of Flores. Rescue, then, was improbable. The *NC-3* must save herself. A crew with radiator water to drink and scant supplies of chocolate and salty sandwiches, must bring a damaged hull for hundreds of miles over seas, running often as high as thirty feet. Could they do it? Could the vessel, built primarily for aerial travel, make such an ocean voyage?

OUT OF THE FOG

They were riding the swells with these thoughts when in middle morning, across a sea clear of fog, the form of a high mountain, its head hidden in clouds, showed ghostly in the distance. Pico! the 7000-foot volcanic cone of the highest peak in the Azores undoubtedly lay before them. Observations, feverishly taken, checked with the testimony of their eyes. They were forty-five miles southeast of Fayal.

Should they make directly for the land they saw? The tanks held a two hours' supply of fuel; the idea was feverishly alluring. Sanity, however, whispered the futility of such a course. They could not safely ride against the waves and wind. Their only road lay eastward, through another night of tossing, toward Ponta Delgada. They must watch the tangibility of that great mountain die away as they planed off toward an island they could not see.

Who can describe those next twenty-five hours? Coasting backwards over the great waves, beaten by rain, sleepless and hungry and worn, the five endured more than even they can tell.

They were blown southward for a time. They lost a second elevator. The right wing float threatened to come loose. Officers trained to use the most advanced navigating instruments trailed canvass buckets over the edge of the hull to assist in steering their craft.

Constantly, however, observations showed an increasingly favorable position. At length they calculated that they could make Ponta Delgada in two hours. Then land appeared—farms, vineyards, roads, a lighthouse! Finally the U. S. S. *Harding* became visible, racing toward them. But they did not want help now.

"Stand aside!" they signaled.

GLORIOUSLY TRIUMPHANT

They taxied over the breakwater and into the harbor. Crowds lined its shores. Whistles, sirens, guns, and voices made a bedlam of the afternoon air. Flags waved gaily, photographers in motor boats raced about. The scene was one never to be forgotten, and our relief from the long tension and our feelings cannot be described.

So ended a fifty-two-hour, 205-mile journey over the open sea. It had been made in a flying boat by officers of the American Navy.

The gloriously battered *NC-3*, though making port, was unable to continue the voyage to Portugal. The *NC-4*, arriving from Horta at Ponta Delgada on May 20, went on alone.

A faint but penetrating hum grew in the sunset over Lisbon. It was an alien sound to the old city beside the Tagus. It seemed to have no location, but to diffuse itself through the sky, growing in volume and intensity.

Suddenly with a jet of steam the U. S. S. *Shawmut* and the U. S. S. *Rochester* sent a shrilling answer.

"There she is!" came a voice, cutting the great spaces like a thin ray of light. Sirens, guns of Forts San Julian and Bugio, cannon of Portuguese warships, and the shouts of innumerable men on land and water echoed from wall to wall of the natural amphitheatre. A silhouette became visible against rosy banners of cloud. It gathered definite shape; the noise of its motors became loud and thundering. With a gleam of wings the *NC-4*, completing the first flight ever made by men across the Atlantic Ocean, dove in a wide spiral toward the river and came to rest upon it as lightly as the vessel of a dream.

There was a moment's pause. Lisbon, lying in the black and gold of a dying May 27, 1919, seemed to ponder on the achievement. Did an intangible sadness, a regret, tinge the moment for her? Once she had her heroes and her navigators. Somewhere among her terraced hills and her half a million people, walked the ghosts of John the Great, Vasco da Gama, Cabral, Prince Henry the Navigator; of Amerigo Vespucci, even-name-giver to a new continent. And here, in 1709, in the Palace of the Indies, occurred one of the earliest aeronautical demonstrations. Bartholomeo-Lourenco de Gusmao had on that day sent a globe to the ceiling of the Hall of Ambassadors before the assembled court—a ball "borne up by certain materials which burned and which the inventor himself had ignited." Where were the explorers now? Where were those who inspired to conquer the air, to fulfill Gusmao's promise of a "machine competent to journey through the air faster than over land or sea, to carry messages five or six hundred miles a day to troops, and even adequate to explore regions about the poles?" They were there, but they were invaders. They awakened Portugal from a dream, shattering her peace with the thunder of their engines

and the flash of strange and amazing wings.

A voice broke the silence. "Tell the *Shawmut* to direct her searchlights westward into the wind, so as to shine upon the water."

A sword of light swung into the dusk and found the *NC-4*. She taxied toward the *Rochester*. A motor boat from the *Shawmut*, hovering in wait, took off the crew. They went up the *Rochester's* gangway, smiling men whose faces were tinged with the gray of a long-sustained and nervous effort.

Tumult and cheering, thunderous cheering, until an abrupt hush cut it sharply, like an invisible knife.

"O say, can you see—"

The anthem of a young but great republic filled the air. The flyers, haggard but happy, stood rigid at salute. About them flags, lights, and uniforms gleamed motionless and dazzling out of the night. The music swelled upward into the dome of darkness, a triumphal hymn of the west sending its warriors east to free men from an impeding nature as it had lately freed them from men. Coming out of the sunset, the *NC-4* had brought the sunrise of a new and great human achievement.

The *NC-4* had a comparatively simple time of it. Two thousand pounds lighter than when she left Newfoundland, she succeeded in taking off from heavy swells at the harbor mouth. Though off her course sufficiently to lose destroyer *No. 3*, she picked it up again and kept it the remainder of the way. Rain and mist were encountered, but did not interfere seriously with the ninety-three statute miles per hour which she made. The voyage was almost a triumphal parade.

There remained only one more accomplishment—the flight to Plymouth. Here, on May 31, they were to set foot on the shores of the harbor from which the Pilgrim fathers took ship for a new world three hundred years before. Here, after a flight of 3936 nautical or 4526 statute miles, made in flying time of fifty-two hours and thirty-one minutes, congratulations of British and American officials were received.

In the days of Columbus it took seventy-one days for his caravels to cross from Palos to the Bahamas. The *NC-4* went from Rockaway to Plymouth, more than twice the distance covered by Columbus, in less than seventy-one hours. Ocean navigation by steam became an assured success by the voyage of the *Savannah* May 24, 1819, from Savannah, Georgia, to Liverpool, England. Both steam and sails were used in this vessel, and the distance was covered in twenty-seven days. The fastest ocean passage by steamship between New York and Plymouth, 2962 miles, was that made by the *Kronprinzessin Cecilie* in five days, seven hours and twenty-five minutes in September, 1909.

The fastest Atlantic ocean passages, recorded by the Cunarder *Mauretania*, were made in four days, ten hours and fifty-one minutes, and in four days, thirteen hours and forty-one minutes in 1909. Ten years later the *NC-4* crossed from New York State to England by a longer route, in two days, seven hours and thirty-three minutes of actual flying time.

It has shown that the Atlantic, like other barriers to the growth of aviation, can be broken down; that, in a word, flight has no limit in the tasks it may choose to accomplish.

The greatest service rendered, however, was that of pioneering. The Navy-Curtiss boats charted a course through new regions. They proved that flight itself offered no problems. They indicated what the real problems were: ability to fix position by instru-

ments, ability to fly through fog to an unseen goal, ability to alight on the ocean in case of need, and to sail the ocean successfully when once upon it. These problems they not only indicated —they partly solved them. They gave the promise of a successful world-voyaging aircraft. Therein lies their triumph. It will increase in significance with years.

Navigating the Plane

By Brice Goldsborough
Vice President Pioneer Instrument Company

RAYMOND ORTEIG, owner of the Hotel Brevoort, New York City, some eight years ago offered a prize of $25,000 to be given to the first to make a New York-Paris non-stop flight.

There have been several recognized trys, and the last one attempted ended disastrously when the plane piloted by Rene Fonck, the Premier French Ace, failed to take the air.

It is interesting to note that in almost every field of endeavor failure is seldom disheartening, and usually just unfortunately delays progress that will ultimately manifest itself. So it is with the long-looked-forward-to New York-Paris non-stop flight. There seems little now standing in the way of the successful completion of that event in aeronautics. Spanning the 3600 mile stretch between New York and Paris is not a formidable undertaking at this time when one considers the progress made in the aeronautical industry since its birth at Kitty Hawk, N. C. in 1903.

It is a recognized fact that airplanes, and motors of present day design, are capable of carrying sufficient fuel to permit them remaining in the air for the period required to negotiate a distance greater than 3600 miles. There are several very important considerations, however, that must not be ignored though offhand they may seem relatively unimportant.

The premise of this discussion is limited to the problem of navigating an aircraft from New York to Paris.

The Art of Navigation

The navigation of a ship, capable of carrying sufficient fuel to permit of its remaining in the air under its own power for a period of time necessary to complete a voyage of some 3600 miles, is and isn't exactly a problem.

It isn't likely that the crew of the ship will be made up of weaklings, either mentally or physically, because in the first place almost every one recognizes that the flight is not just a matter of pointing a ship toward Paris, and after forty hours or so having Eiffel tower loom up on the horizon; and in the second place endurance physically means that the crew, either two or three, will be pretty much on the job for a stretch of some forty hours, more than likely without sleep.

Navigation of slow moving ships, that go down to sea, is an art that has been practiced for centuries, and to these century-old methods we must look for some of our methods in air navigation.

But as the methods changed somewhat when we changed from sail to steam, so must we change from steam to aircraft. There is in aircraft navigation a composite of both the sail and steam; wherein the sailing vessels were at the mercy of the winds and currents of the several seas, and wherein their directions and speed of sailings were limited pretty much by the directions and force of the winds, they after a fashion reached their port but not always on schedule. Attempts to keep a schedule were more successful by innovating the steam driven seacraft, although affected similarly by the wind and sea. Aircraft, however, is capable of making port, no matter from which direction the wind may be blowing whether helping or hindering

forward progress; and during these impending flights from New York to Paris strict adherence to a schedule will be very, very necessary.

THE GROUND WORK

The ground work in preparation for important flights of this nature entails some little effort.

The navigator must first determine what his course will be. On the Hydrographic Office Chart of the North Atlantic Ocean, a great circle track between New York and Paris has been plotted. The great circle track is the shortest distance between two points on the earth's surface.

Just in passing, it might be interesting to note that great circle flying is not the usual method of ordinary navigating of aircraft over land, because on the airways as established, the distances between points are very much shorter, and in these shorter hops pure triangulation can be resorted to without appreciably lengthening the course.

This latter method has been well-worked out, and has been proven quite conclusively by such important flights as the one recently completed in the Josephine Ford, the three-motored Fokker that Commander Byrd and Floyd Bennett flew over the North pole. Floyd Bennett, Bernt Balchen, and J. McPhail made up the crew-carrying representatives of the Department of Commerce and the Guggenheim Fund for the promotion of aeronautics. This particular flight was made up of forty-four legs for a total distance of some eight thousand miles but was not a non-stop flight; the longest leg between take-off and landing was not more than 400 miles. The navigating method used for this flight was typical of that practiced in most cross country flights over land, and the same that was used by the writer who navigated the winning ship in the last Commerical Reliability Tour. This method was tried out and perfected by Charles H. Colvin, president of the Pioneer Instrument Company. The use of this method involves only a few of the instruments necessary for "Great Circle sailing," primarily, good maps with fields correctly located geographically, and some means within the ship to check speed, distance, direction, altitude, attitude of the ship and time.

The World Flyers, however, had to use both methods, that is, the simple cross country and the more involved Great Circle method.

However, to get back to the New York-Paris flight, the course as plotted indicates the ideal route to be followed. The actual calculated distance is 3135 nautical miles on the great circle between Mineola, Latitude 40° 44′ 18″ N., Longitude 73° 37′ W. and Paris, Latitude 48° 50′ N., Longitude 2° 20′ E.; 3135 nautical miles equals 3610.1 statute miles.

For the purpose of conveniently establishing checking points and courses, in ship's parlance, a day's run, legs 300 miles long, have been plotted. These legs do not exactly follow the great circle, but rather describe the sides of a polygonal figure and are sufficiently accurate for all practical purposes.

The initial course of departure is true 53° 51′ but it is noted that angular relation of the magnetic field, between the meridian and the magnetic pole, is from 10° to 20° W. This variation or declination must constantly be kept in mind because in aircraft, as in maritime vessels, the compass is the only means known showing continually a given direction, and inasmuch as this variation is hardly the same for any two locations, the importance of knowing its magnitude is paramount.

THE COMPASS

A word about compasses may not be out of order. There have been several types of magnetic compasses developed for aircraft use, but probably the outstanding contribution to the art in way of compasses is the well-known earth inductor compass, invented and designed by Morris Titterington, chief engineer of the Pioneer Instrument Company. This latter compass has been demonstrated by use on such important flights as the Round-the-world, Rodger's *PN-9* San Francisco to Hawaii, Byrd's Polar Flight, Wilkin's Arctic Expedition, the Commercial Reliability Tour, and scores of others. The great advantage this particular instrument has over the ordinary magnetic compass, is that it can be remotely located in an area free from local magnetic influences inherent in every airplane, due to the motors and to the magnetic material of which it is constructed.

The indicator of direction which in itself is not affected by local surrounding fields may be located so that it can be easily observed by the pilot.

A controller, by which the earth inductor compass is set to the desired heading, is placed where it may be operated by the navigator. This instrument has dials, upon which are set the direction to be flown, and the pilot has only to watch a meter, which shows any departure to left or right of the proper course.

INSTRUMENTS AND APPARATUS

So that the reader may more clearly understand the flight as it unfolds over the plotted great circle track, there follows a description of the several instruments and apparatus the navigator must use to determine his direction, position, and kindred other things he must know at all times.

The power plant instruments are not so much the concern of the navigator, but the pilot must know whether he is getting the most economical efficiency from the motor or motors, and to know this, the speed of the motors as indicated by the tachometers is essential. Usually, the power plant instruments are grouped so that an occasional glance directed away for an instant from the compass or compass indicator and the turn indicator, will impart to him information that the oil pressure and oil temperature, as indicated by two small gauges, is correct for the particular motors used for the flight.

The actual navigating instruments, however, are the compasses already described, a turn indicator, which is an auxilliary instrument used in conjunction with the compass for indicating small divergences from a straight course (in itself, the turn indicator has no sense of direction but will indicate when on a given course any departure from that course); an air distance recorder which in its function is not unlike the Taffrail logs used by ships in the maritime service. While not giving the distance made good over the ground it records counter fashion the number of miles made good in the air, and this information is very helpful when checking position. Unlike the air speed indicator, which shows the average miles per hour at all times, this instrument keeps a record of the miles flown.

The air speed indicator is not alone simply a measurer of speed, but is a telltale as to the performance of the ship, indicating to the pilot whether he is maintaining steady, constant flight, or whether he is approaching a condition near the stalling point of the ship, and indicating to the navigator the average rate of speed the airplane is making with relation to the air. It is important to know the ground speed as well as the air speed, and the particular instrument used for determining this

has incorporated in it a means of measuring the drift angle. The drift, as it is termed, is the movement of the airplane in directions apart from the forward motion produced by the motors. The ground speed is obtained by a visual method. The observation of an object on the ground, or the smoke from a smoke bomb at sea through the ground speed meter, will give you this if you know the altitude above that object. The altitude is readily obtained from an altimeter on the instrument board. Knowing the altitude, you have just to set a pointer on the speed meter at the height indicated by the altimeter, time the transit of the object between the two set pointers and read directly from the speed timer the ground speed in miles per hour.

The drift meter is arranged in such a way that visual observations of an object on the ground are possible. The vane index is a pivoted arrangement that passes over an arc divided in degrees. Normally, the vane is neutral in the fore and aft plane of the aircraft. If when sighting through the meter the object appears not to parallel the vane index, the vane is moved until a parallelism is established, and once this condition is satisfied, the angle of drift can be obtained from the arc. The drift angle must be considered at all times since it measures the difference between actual and apparent line of flight. As an example, the magnetic course flown at the departure from New York, on the illustrated Great Circle track, is normally 69°, and if a wind whose velocity of 20 m.p.h. is bearing from the west on a magnetic heading of 259°, the drift angle obtained from the meter will be nearly four degrees; then to make good a course of 69°, with a slightly tail wind of 20 miles per hour, it will be necessary to head the ship 4° toward the wind and to fly a magnetic course of 65. In other words, the apparent line of flight will be 65° by compass, but the actual line of flight will be 69° by drift. Since this particular example wind is a helpful one, the ground speed of the ship, if the air speed is 100 m.p.h., will be nearly 115. The exact course and exact distance can be readily calculated by setting the various factors into an instrument called the course and distance indicator, which simply is a mechanical means of solving all triangles.

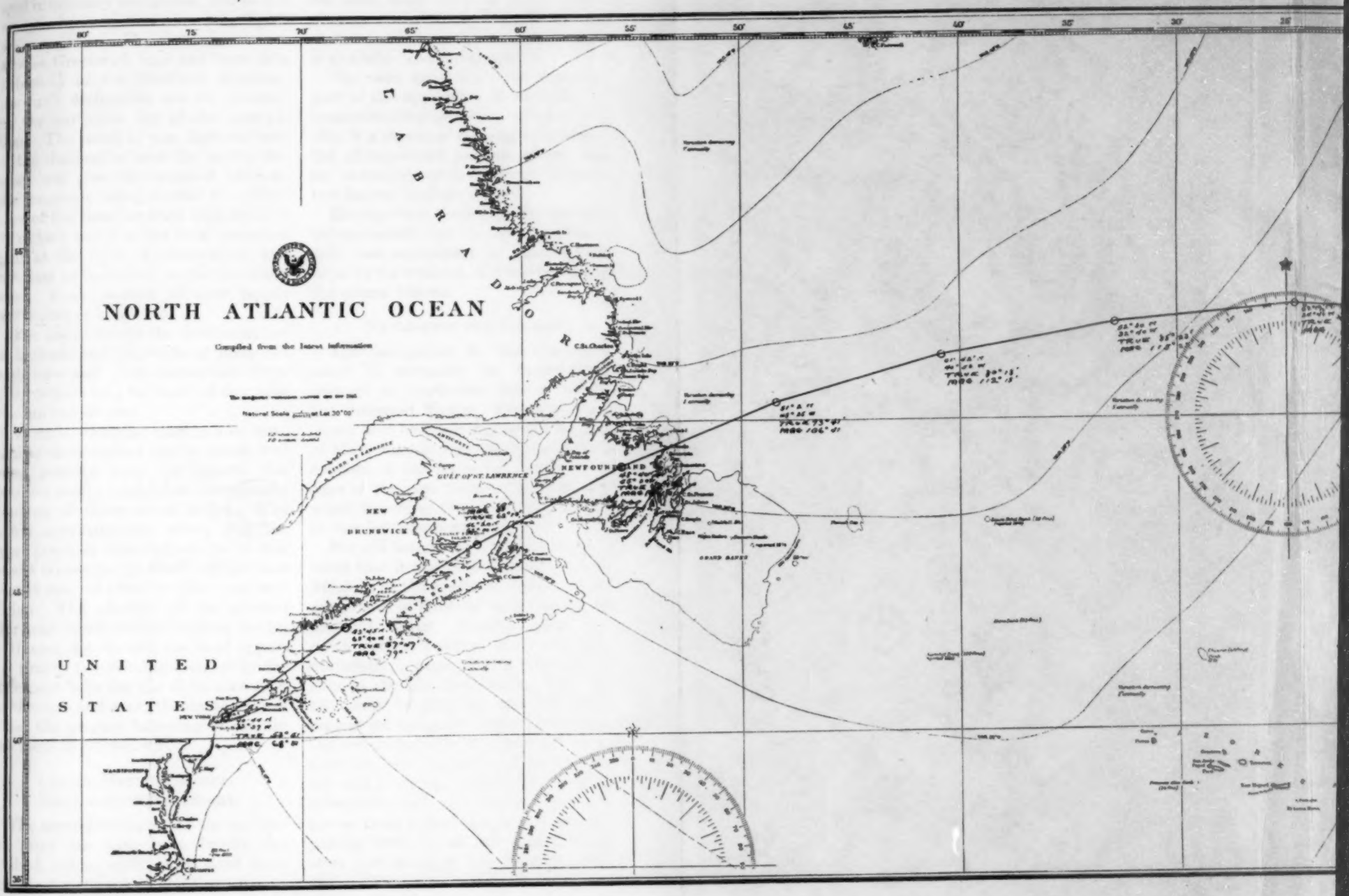
The aircraft sextant, or octant, and the chronometers have an important bearing on the problem, because through their means it is possible to determine a position of a point or place on the earth's surface at anytime and anywhere, provided it is possible to see any of the astronomical bodies that pervade the celestial sphere.

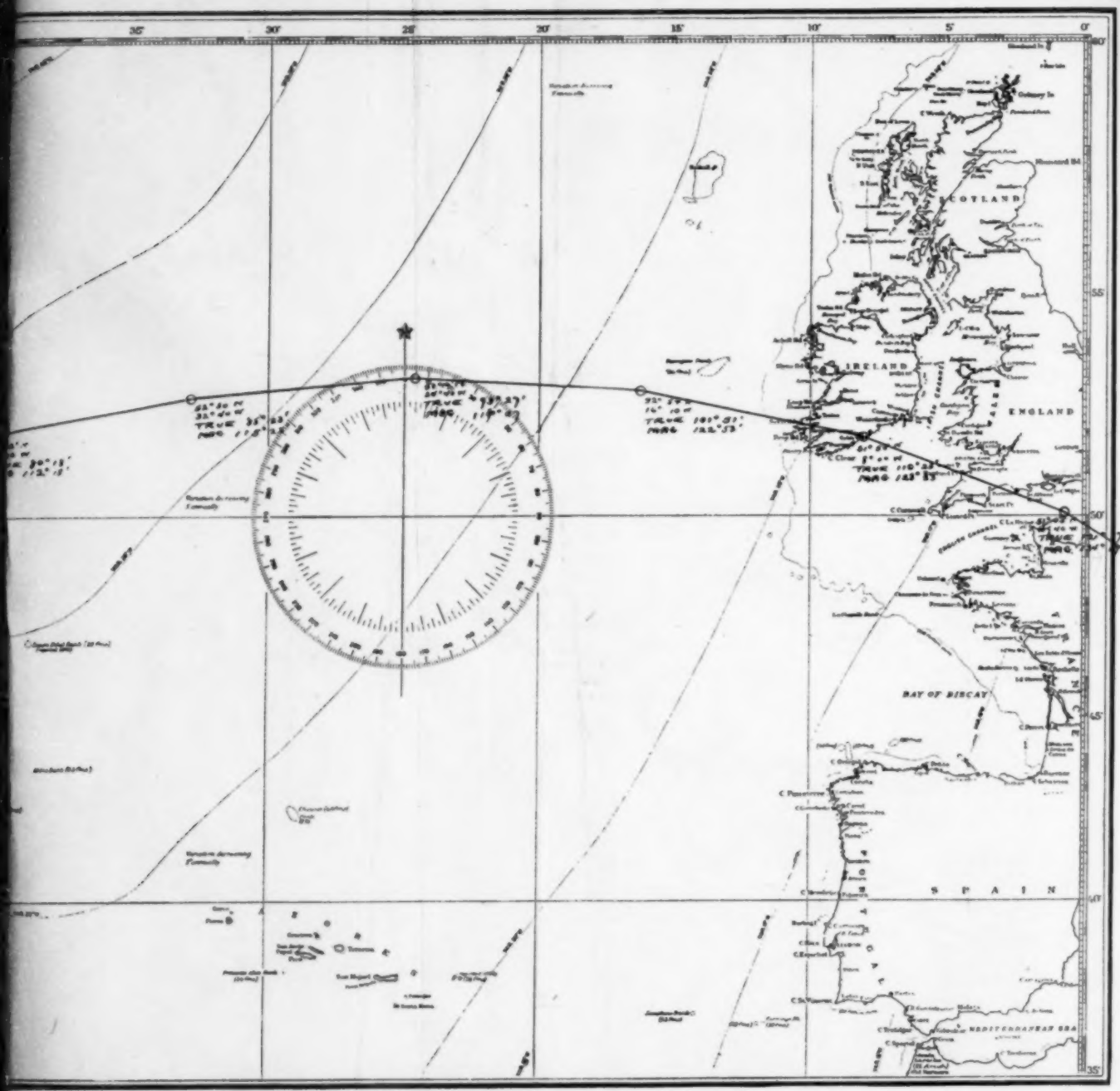
The sextants and octants used in air navigation differ from the ordinary marine sextants, in that they are fitted with a bubble that substitutes for the horizon. The use of the bubble eliminates the necessity of entering a correction for the height of the observer.

It will be noted that the chart illustrated is divided in sections denoting latitude and longitude. The location of certain points on the Great Circle track are fixed latitudinally and longitudinally, and if from observations it is determined that the ship is not exactly on the course, a new location can be fixed and a new Great Circle can be plotted.

Determination of latitude and longitude during the day is usually done at noon by observation of the sun as it passes the highest altitude on the meridian. This altitude or angle, as measured by the sextant, is the desired meridian altitude. After applying the necessary corrections and subtracting from 90° the result is the zenith distance.

Greenwich time is the accepted time


NORTH ATLANTIC OCEAN
Compiled from the latest information
LABRADOR
NEWFOUNDLAND
GULF OF ST. LAWRENCE
NEW BRUNSWICK
NOVA SCOTIA
UNITED STATES


35'
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40'
35'
SCOTLAND
IRELAND
ENGLAND
BAY OF BISCAY
SPAIN
MEDITERRANEAN SEA

used in ordinary navigation, and so it is used in air navigation when long flights are engaged in. The chronometers are kept at Greenwich time and from data published in the Nautical Almanac, the sun's declination can be obtained for the particular day of the observation. The result of the algebraic sum of the declination and the zenith distance will give the required latitude, the longitude being merely the difference of the time between high noon or 12 o'clock which is the local apparent time at the point of observation, and the time as indicated on the chronometers. Each minute of time equals one degree of longitude.

The above covers the determination of latitude and longitude at noon but with care and some calculation these observations may be made at any time the sun can be seen.

At night when the stars can be seen, similar observations can be made, and since position must be known, this position can be established through the medium of these astral bodies. You know approximately where you are from previous observations, so in this case it is essential to select a bright star that is near or about to pass your meridian. The identity of the selected star must be established without doubt.

Having determined the local apparent time of the meridian passage by the difference between the right ascension of the sun and star, thence the mean time, the process following is exactly the same as for the sun.

LATEST METEOROLOGICAL INFORMATION NECESSARY

The several instruments the navigator must use have been briefly described, but in addition he must have the latest meteorological information to determine closely the best time to make the flight, so that he may be able to take full advantage of helpful winds. He also must have nautical tables, almanacs and lists of radio compass stations. This published information is available and indispensable.

The radio apparatus is an important part of the equipment, if used only for communication purposes. However, it also is a means of helping to establish the all-important position of the ship, by obtaining cross bearings between two known stations ashore.

Having thus described the incidental equipment that the navigator has as aids, and equipment he could hardly hope to do without, the navigating of the course follows.

NAVIGATING THE COURSE

The navigation in this discussion must of necessity be hypothetical because no particular date is set for the proposed flights. However, they would well be made during the months of May, June or July, not alone for the comfort of the personnel, but at that time of the year the prevailing helpful winds known as the "westerly trades" in this latitude predominate.

We will assume for the sake of argument that it has been decided to leave Mineola at the break of dawn so that our arrival in Paris be made during the daylight hours. Usually with the dawn comes a breeze that will help materially in taking the heavily loaded ship in the air, and besides, too, the pilot must be given an even break, his biggest job being all in the first minute, the rest so far as he is concerned being more or less routine. Once in the air, and I say that advisedly, the ship is headed rapidly on a course that bears across Long Island Sound. If the departing time is, say, 5 o'clock, then after four hours at one hundred miles an hour the western shore line of Nova Scotia should loom up. Since this shore line is directly on the course, it isn't likely that an off course error will

enter into the problem. But before reaching this coast line, it will be noted that the original compass course of 69° for the first leg has been changed to 79° at the beginning of the second leg, to take care of the bend in the Great Circle. Consideration of the wind has not been taken although an assumed wind, of the direction and force as described previously, would materially help the ground made good. After following the coast up, and having arrived at a point off Prince Edward Island, it will have been found that the air distance recorder shows less than the six hundred miles made good, because the wind has helped at the rate of some fifteen miles per hour, and as a result a ratio is established which will help in checking position later.

Local time changes one hour each 15° of longitude, and now that we are nearing Longitude 60, we have gained one hour so that the local apparent time is about 8.45 A.M. The hop from Prince Edward Island, over a point on Cape Breton, to the mainland of Nova Scotia on a new course of 88°, plus or minus the observed drift angle, brings us to the beginning of the fourth leg.

The flight up to this point has given the navigator ample time to have checked and put in use all the instruments necessary for the continuation on the course. He would have been able to have checked his position from time to time and to have gotten well set for the long hop over sea.

The local apparent time, at the point where the ship will leave the mainland of Newfoundland, will be one and one-half hours less than the time at the point of departure. At the rate of one hundred and fifteen miles per hour, there will have been elapsed less than ten hours for the thousand miles.

There remains now about sixteen hundred miles of flying, and about fifteen hours in the air before the coast of Ireland is sighted. Twelve hours of this time most certainly will be spent in darkness, but if the time selected for the flight be during the full of the moon, they will experience the romance of moonlight on the ocean.

This distance, between Newfoundland and Ireland just about equals that covered by Byrd and Bennett on their flight over the Pole and return.

Once the coast of Ireland is sighted, which will be sometime during the morning of the second day out, the remainder of the flight will be comparatively easy, but the big problem that the navigator has to contend with, will be constantly checking and rechecking by observations on the moon and stars to assure himself at all times he has not departed from the Great Circle track. Variation in direction and magnitude of the wind will tend to keep him off the true course, and where his important job comes is, as in the beginning, knowing where the ship is at all times, so that when necessity arises to change his course there will be no question in his mind.

And since these flights will not be attended by positioned ships, because this course lies well to the north of the regular steamer lanes, the success of a New York-Paris Non-Stop Flight will reflect untold credit on the design of the ships and motors, on the endurance of the pilot, and on the skill of the navigator in using modern navigational instruments and equipment.

Meteorology and Its Application to Flying

By Willis Ray Gregg, A.B.
Meteorologist in Charge of Aeronautical Division, United States Weather Bureau

IN a very interesting and attractive booklet entitled "Flight in Literature," Major Ernest Jones shows that, from the earliest recorded times, man has desired, and in many cases has tried, to fly. So appealing to him was the idea of imitating the birds, that he peopled the air with all sorts of winged spirits, and in his imagination even endowed certain legendary leaders and heroes with the faculty of flight.

Early Interests in the Weather

To an even greater extent, perhaps, man has, since the dawn of history and probably for countless ages before, been keenly interested in the weather. The literature of all peoples is rich with weather proverbs, many of which are based on actual observation, although others are largely the result of superstition. The meteorological elements to which most attention was given were winds and clouds, particularly the latter, thus showing a very early interest in the conditions of the upper air. It can hardly be said that flying and weather were closely associated in the minds of these early observers, and yet it seems fair to assume that occasionally one more keen than his fellows, noting the direction and speed of the clouds, may have speculated as to the journey he would take, could he rise to their height and travel in the air currents that were speeding them along.

A really close relationship between meteorology and flying began only with the development and use of the man-carrying balloon. And singularly enough, this relationship was quite the opposite of that existing today. The balloon then provided a means for adding to man's knowledge of the characteristics of the upper air, notable contributions being made, for example, during the classic voyages of Glaisher, Flammarion and others. Now, on the other hand, the meteorologist tells the flier what the weather is along his course, and what changes are likely to occur in that weather during his flight.

During the past quarter of a century tremendous strides have been made in the development of aeronautics, and this development has brought out, to an extent that could scarcely have been foreseen, the necessity of providing for it a more detailed weather reporting service than is required for any other line of human endeavor. The truth of this statement was strikingly brought out during the World War, when extensive and very complete meteorological services for the aid of flying operations were built up by all of the nations engaged in the conflict. Following the War came the necessity for rigid economy and the consequent dropping of much that should have been retained. Aeronautics suffered a most discouraging slump, from which it is only now beginning to recover. With it there was a similar and quite natural slackening of effort in meteorological service, but that, too, has recently received most encouraging support and, unless all signs fail, will shortly be developed in greater detail and far more effectively, as regards frequency, promptness and completeness of reports exchanged along airways, than could have been imagined

a few short years ago. This being the present status and the future outlook, it seems worth while to discuss briefly the nature of the service that meteorology can render aeronautics, to indicate what is now being done to make such service effective, and to point out the lines along which future development should proceed.

How Meteorology Can Aid Aeronautics

The service that meteorology can render aeronautics may be considered broadly under two general headings: (1) Statistical information, required particularly in the earlier organization stages of airways; and (2) current information and forecasts, essential for the efficient operation of airways after they are organized and are working on a regular schedule basis.

1. Statistical information may, for our present purpose, be further divided into two classes: (a) that needed in developing the ground organization, and (b) that useful in determining regular flight schedules.

(a) Under this heading are included such climatological factors as frequency of different wind directions at the surface; average speed of surface winds, classified by direction; frequency of surface winds exceeding selected limiting velocities, also classified by direction; frequency of gusty winds of different directions; visibility; frequency of fog; and excessive precipitation, including heavy snowfall.

As a rule there can be no great latitude in the location of airports, since these will necessarily be near the larger centers of population, and must be within reasonably easy access to them. In these cases little if any use can therefore be made of information concerning certain other climatological factors, not above enumerated, such as frequency and intensity of thunderstorms, violent storms and temperature extremes, since in a small region their variation would be slight.

On the other hand there is often considerable variation in wind conditions, and visibility and occurrence of fog, even within small areas. Wind gustiness is greatly increased by topographic irregularities, buildings, and trees. A region as nearly free from these as possible should be selected. Information as to frequency of different directions and velocities is important in connection with the orientation of hangars, and the layout of runways. Visibility varies materially on different sides of cities, and to some extent the same is true of fog at places along the coasts, or near large inland bodies of water. River valleys and other low-lying regions are on this account to be avoided, so far as possible.

A knowledge of the precipitation characteristics of a place is useful in connection with grading and draining the landing fields. If heavy snowfalls are to be expected, provision should be made for quickly clearing the landing fields, particularly the runways.

(b) Climatological factors useful in determining regular flight schedules include resultant winds at flying levels; frequency of different wind velocities, classified by direction, at flying levels; frequency of widespread storms; frequency and intensity of thunderstorms; frequency of low clouds and fog; visibility; and general character of precipitation.

In determining flight schedules for any proposed airway the most important datum is, of course, the cruising speed of the aircraft employed. To this must be added, or from it subtracted, the resultant wind at different points along the route. This corrected

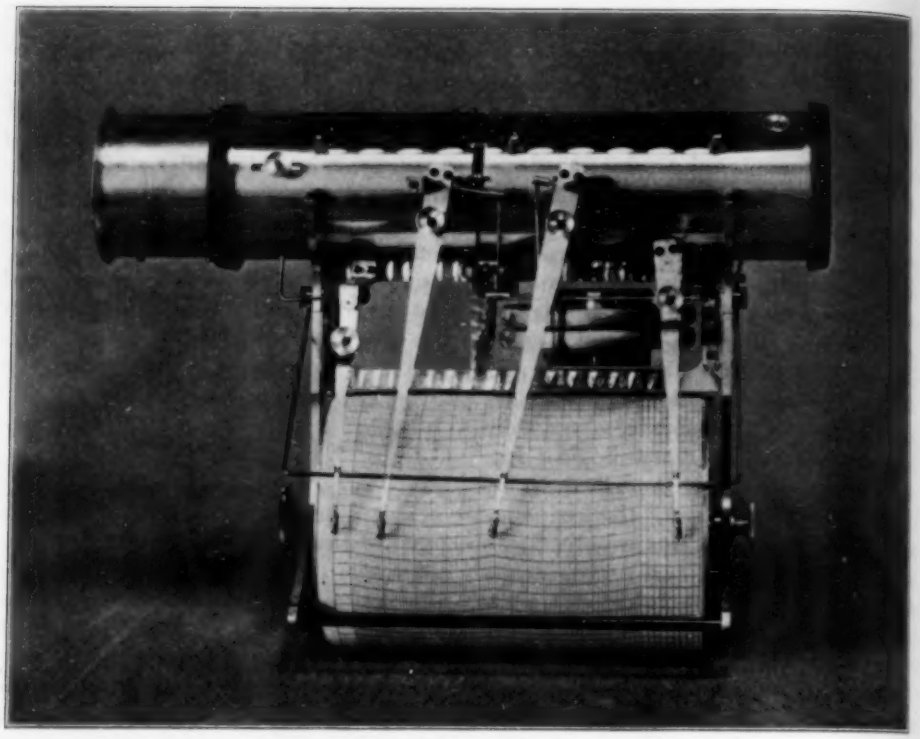
value forms the proper starting point or basic datum for schedule fixing. Normally, in the course of a year or any other period adopted, flights would be completed on or ahead of the schedule based upon this value approximately fifty per cent of the time. Obviously this would not be a satisfactory schedule. A guarantee of at least as high a percentage of arrivals on time as is realized by other means of transportation, would seem to be desirable. But, whatever percentage performance is adopted as satisfactory, appropriate time schedules can be determined from an analysis of the climatological factors above enumerated. Of these by far the most important is the frequency of head and cross winds, resolved into components parallel and perpendicular to the course. Since, in general, wind velocities increase with altitude, and since, moreover, in middle latitudes westerly winds are more frequent than are easterly, it would usually be found that the most efficient altitude for regular flying would be lower for westward than eastward trips. Consideration should also be given to other factors, such as the frequency of widespread storms and thunderstorms, low clouds, fog, poor visibility and heavy precipitation, especially snow, some of which might not only delay but occasionally altogether prevent flights.

2. Average values, though essential for the purposes above outlined, are useless in individual, day-to-day flying, which requires, first, frequent reports as to conditions all along the route; and second, weather forecasts for one, two, three, etc., hours, depending upon the length of the flights and the means of communicating supplementary information en route. Fog, visibility, cloudiness, including height of low clouds, precipitation, thunderstorms and squalls, and wind direction and velocity at different heights are the principal meteorological elements concerning which information should be available at all times. Provision should be made for observations of these elements at selected points along a course, taken at regular stated intervals, and for supplementary observations at times when conditions are changing rapidly. A system of communications should be devised and installed so that this information can be disseminated quickly to all airports, and to aircraft in flight, when the latter are equipped with radio.

STATISTICAL INFORMATION NOW AVAILABLE

The climatic characteristics of all parts of the country are known in considerable detail through the records that have been accumulated and summarized by the Weather Bureau at about 200 regular, fully equipped stations, and at about 4500 additional cooperative stations. The data for the latter are less complete than those for the former, but nevertheless include prevailing wind direction, average cloudiness, frequency of fog and thunderstorms, frequency and amount of precipitation, and in many cases temperature means and extremes. The 200 regular stations, located for the most part in the larger cities, have in addition detailed information concerning wind velocities, including the occurrence of gales. In some places that may be selected for airport sites, remote from stations of either class, it might be necessary to make a series of special observations in order to determine the proper orientation of buildings, etc., but it is believed that in general the data now available are sufficient, in large part, for the preliminary or ground organization stage of airways.

For the next step, that is, the determination of schedules, there is an



WEATHER BUREAU KITE METEOROGRAPH

The tube at the top contains delicate instruments attached to the pens which record on the paper sheet the changes in pressure, temperature, moisture and wind at various heights.

abundance of data for all parts of the country east of the Rocky Mountains. These data have been secured by means of kites and balloons, and have been summarized in such a way as to show average and extreme winds, frequency of different directions and of different speeds at all altitudes likely to be used in flying. There is considerable similar information, not yet summarized, for the Pacific Coast States but very little between them and the Plains States, although a study of the air mail records between Cheyenne and San Francisco indicates in some measure the wind characteristics of this region. Data as to visibility and cloud frequency and height are likewise abundant except for the mountain and plateau regions of the west.

Much of the information above referred to has been summarized in one form or another but for the most part these summaries, prepared for other than aeronautical needs, give data concerning meteorological elements of little use in aeronautics, and omit other data a knowledge of which is vital, such as visibility, cloud heights, etc. The Weather Bureau is, therefore, now engaged in preparing, for early publication by the Department of Commerce, Aeronautics Branch, a series of bulletins, one for each State, summarizing in concise form the meteorological elements affecting aeronautics. Besides the State bulletins there will be brief statements describing general conditions at all main airports and at many of the intermediate landing

fields along designated airways. Some of these bulletins are practically ready for publication now, and the remainder are being prepared as rapidly as practicable.

EXPANSION OF SERVICE

By far the most important service that meteorology can render aeronautics is that of furnishing up-to-the-minute weather reports for all scheduled flights. Prior to July 1, 1926, this had been done in the case of special projects, such as transcontinental and trans-Atlantic flights, national and international balloon races, etc. The passage of the Air Commerce Act of 1926, and of an appropriation for putting its provisions into effect, has made possible the development of a regular service specially designed for the needs of aeronautics. Action to organize such a service was taken in July, 1926. At that time the Weather Bureau had sixteen pilot balloon stations in the United States proper as shown in Figure 1. It was recognized that there should be additional stations of this type along the airways then in existence or soon to be organized, and the funds provided by the appropriation permitted the establishment of nineteen such stations, the locations of which are also indicated in Figure 1. In some cases it was found possible to conduct this work satisfactorily at the city offices of the Weather Bureau, maintaining contact with the airports by telephone. In other cases, where suitable facilities were available, the balloon work has been placed at the airports owing to their considerable distance from the city offices, or to the poor observing conditions at the latter on account of smoke. This arrangement, having the meteorologist at the airport where he can personally discuss the weather conditions with pilots, is the ideal one, and it will probably be adopted quite generally as aeronautics

THICK LAYER OF STRATO CUMULUS
Photographed from an airplane. Cirro-stratus above.

develop into a twenty-four-hour service, and as facilities, including quarters, personnel, and communications are made available.

The upper air data concerning wind direction and velocity are important, since they determine at what height a pilot can make the best speed. Many instances have been reported in which this information has resulted in a much quicker trip than would have been possible otherwise, and in one case it enabled a pilot flying from Cleveland to Chicago to establish a new record.

Of greater importance, however, is a knowledge of surface weather conditions, since these determine whether or not any flight at all can be made. Fog, low-lying clouds, excessive rain, sleet or snow, severe thunderstorms, and very poor visibility render flying hazardous and impracticable. Not always will this be so, but in the present state of the art it is. Therefore, particular attention is given to these conditions, not only at the upper air stations, but also at those Weather Bureau stations where observations are confined to surface weather, and in many cases at intermediate points along the airways.

EXCHANGE OF REPORTS

The observations are of little use unless they are made known to pilots at the proper time, which of course is just before he begins his flight. This is an easy matter, so far as the conditions at the starting point are concerned. But naturally he is much more interested in conditions at his destination and at all points along his route. As soon, therefore, as the observing stations were established, steps were taken to inaugurate as complete a system of weather reports as was possible with the funds provided, along all commercial airways that

FIGURE 1

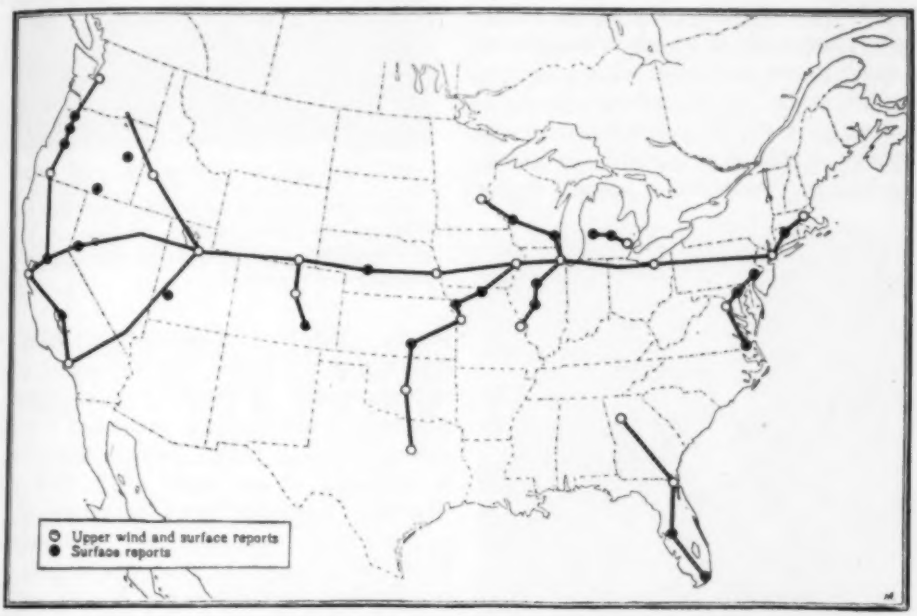
PILOT BALLOON STATIONS OF THE WEATHER BUREAU

were officially recognized as such by the Department of Commerce. Figure 2 shows these airways. Two of them, Atlanta-Miami and Philadelphia-Norfolk, suspended operations during the winter, but the remainder have maintained very nearly regular schedules during most of the time since July, 1926.

The points between which weather reports are exchanged are also indicated in Figure 2. There are in addition several stations, thus far maintained by the Post Office Department, on the transcontinental airway from New York to San Francisco. The reports on this airway and also those on the Salt Lake City-Los Angeles Airway are transmitted by radio. Those on all other airways are sent by commercial telegraph or telephone, whichever is the more prompt and dependable. Ultimately it is planned to have a system of communications that shall be under absolute control, either radio or leased wire, since otherwise there is bound to be occasional delay when the volume of commercial business is large. However, by "priority" arrangement the present system has for the most part proved to be quite satisfactory.

Whether sent by radio, telegraph, or telephone, the reports are based upon observations made as short a time before the take-off as possible and still assure their receipt in time for use. For example, through the courtesy of the Colonial Air Transport officials, the writer recently had the privilege of going by airplane from Hadley Field (about forty miles south of New York) to Hartford, Conn. The start was made at 5 A.M., and a weather report from Hartford was received at 4.50 A.M. As this report came by telephone, it showed conditions prevailing practically at the time of take-off. When reports are sent by telegraph,

FIGURE 2



SYSTEM OF WEATHER REPORTS ORGANIZED BY THE WEATHER BUREAU FOR COMMERCIAL AIRWAYS

there is a somewhat longer interval, but seldom is this greater than half to three-quarters of an hour. In all cases the reports give the general character of the weather, as clear, overcast, rain, snow, etc.; ceiling or height of low clouds; visibility; and wind direction and velocity. In some of them pressure and temperature are included; also, upper wind direction and velocity at different levels from stations where pilot balloon observations are made. Reports of upper winds at night are based upon observations of pilot balloons from each of which is suspended a small paper container with a lighted candle inside (a miniature Japanese lantern). With this simple and inexpensive device it is possible to follow the balloons well above normal flying

WEATHER BUREAU THEODOLITE

Kites and balloons are watched through the telescope, and the angular readings on the circles make possible the determination of wind velocity and direction.

BEGINNING OF A WEATHER BUREAU PILOT BALLOON ASCENSION

Small rubber balloons, filled with hydrogen, are followed, in their ascent, by means of a theodolite. The readings of the horizontal and vertical circles enable the observers to construct a horizontal projection of the balloon's path and to determine the wind direction and velocity at various altitudes.

levels. Wherever balloons are used, either day or night, the ceiling is of course easily determined. In some places it is observed by means of a so-called "ceiling light" which projects a spotlight at an angle of forty-five degrees. The observer then paces off, or otherwise measures the distance from the ceiling light to a point exactly underneath the light on the clouds, and this distance is of course the same as the height of those clouds. In the absence of balloons or ceiling lights the cloud height is estimated as closely as possible by eye observation. Visibility is determined by noting the greatest distance at which conspicuous objects (lights at night) can be seen. Wind vane or cone and an indicating or "buzzer type" anemometer readily provide the surface wind data. Temperatures are ordinarily of little concern, but are wanted when they are near and below freezing, since the formation of ice on the planes when pass-

BEGINNING OF A WEATHER BUREAU KITE FLIGHT

Attached to the kite is a small instrument known as a meteorograph. Upon a clock-driven cylinder small pens automatically record air pressure, temperature, humidity and wind velocity at various altitudes. Wind direction is determined from the direction in which the kite flies.

ing through clouds or fog at these temperatures is one of the most serious problems with which the pilot has to deal. Very low temperatures also require proper protection in the form of heavy clothing, or arrangement for heating the cockpit and cabin. Barometric pressure readings make possible suitable adjustment of altimeters. This is important if the pressure gradient is steep, as otherwise an altimeter is likely to indicate a height that is considerably in error, thus making landing a difficult and possibly a hazardous matter.

FORECASTS

In the early days of flying, pilots in general paid comparatively little attention to forecasts, unless a very long flight was contemplated. For short trips current reports were deemed sufficient. Many experiences, however, some of them involving considerable hazard and a few of them resulting in accidents, have shown very clearly that a condition reported as existing at any given time may, and often does, change decidedly in the course of so short a period as an hour or so. The pilot, therefore, now wants not only a current report, but also a statement as to what is likely to occur during his flight. This feature of the service has been developed for nearly all of the commercial airways, and will shortly be extended to the remaining ones. The forecasts are what may be designated "short range"; that is to say, they cover specifically the time and route of each scheduled flight, and are issued shortly before the beginning of that flight. They give the forecaster's opinion as to probable changes in existing conditions. In addition to

BEGINNING OF A WEATHER BUREAU SOUNDING BALLOON ASCENSION

These balloons carry self-recording instruments to great heights, the record being about 20 miles. Records of pressure, temperature, moisture and wind at various heights are obtained.

these short range forecasts the usual forecasts for twelve to twenty-four hours are available and these are useful in a general way in planning the next day's program. Forecasters do not pretend to say whether or not a flight should be made. They endeavor simply to point out what, in their judgment, the weather will be, leaving to the pilots or those in charge of flying

CAPTIVE BALLOON ASCENSION ON MOUNT WHITNEY, CALIF.

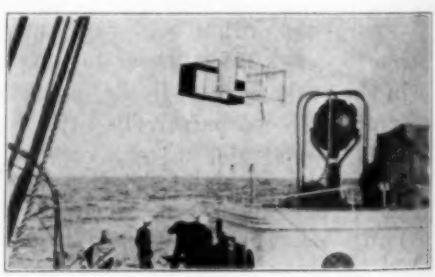
operations the decision as to whether or not the flight should be undertaken.

THE FUTURE

Those of us who believe in aeronautics, and the number is happily growing by leaps and bounds, foresee a development in the not distant future when it will occupy a prominent place in the commercial life of the nation, not supplanting, but supplementing in a large way other types of transportation. This development means

FOG APPROACHING MOUNTAIN TOP FROM VALLEY BELOW

a similar expansion and intensification of meteorological service. With twenty-four-hour flying it will be necessary to have a meteorologist on duty throughout the day and night at all important airports, and to arrange also for special reports from intermediate points. A prompt and effective system of communications will be developed whereby not only will weather reports and forecasts be exchanged between airports as at present, but in addition, when conditions justify such action, warnings will be radioed to aircraft in flight or sent to



KITE FLYING AT SEA

intermediate landing fields where signals will advise pilots to land or turn back, if necessary. Upon an adequate system of communications depends in large part the success of meteorological service; in fact, communications may be called the "backbone" of the service. With such a system and with weather reports and forecasts for all flights, day and night, the hazards of flight which unfortunately, and in considerable measure unjustifiably, loom large in the public consciousness will vanish, and aeronautics will "come into its own." It is along these lines—providing detailed and intensive meteorological service—that the Weather Bureau and the Aeronautics Branch of the Department of Commerce are now working.

Air Regulations

By William P. MacCracken, Jr.
Assistant Secretary of Commerce for Aeronautics

THE Air Regulations of the Department of Commerce, authorized by the Air Commerce Act of 1926, were put into effect on December 31, 1926, and cover five of the six main divisions into which civil aeronautic activities may be grouped. The sixth subject will be covered by regulations within a short time.

Regulations of the Air Commerce Act

These six divisions are as follows:

1. Licensing of aircraft.
2. Licensing of airmen.
3. Marking of aircraft—licensed and unlicensed.
4. Requirements in the operation of aircraft.
5. Air traffic rules.
6. Rating of air navigation facilities.

Certain classes of aircraft must be licensed, specifically those engaged in:

A. Carrying persons or property for hire or reward, or the United States mails—

1. Between two or more states, or to or from foreign countries; as from Chicago to Dallas, Texas, or from New York or Portland, Maine to Montreal, Canada.

2. Between two points in one state if a part of the flight is over another state, as from Buffalo to New York, via Susquehanna, Penna.; or from Buffalo, thence over any part of Pennsylvania, and hence back to Buffalo.

3. Between two points in one state if it is a part of a through carriage between points in different states, or countries, as from Los Angeles to San Francisco, Calif., as a part of the carriage between Los Angeles and Seattle, Wash., or from San Antonio, Texas, to Laredo, Texas, as a part of the carriage between San Antonio and Monterey, Mexico.

4. Within the air space over the District of Columbia or any territory or possession of the United States.

B. Flying between points in different states, the District of Columbia, or territories or possessions of the United States, or to or from any foreign country, for the operation in the conduct of a business, as where the aircraft is used in a business in one state, territory, or possession of the United States, or the District of Columbia, and is flown to another state, territory, or possession for use in the business in that state, territory, or possession. Applied to concrete facts, it includes the aircraft which is used in state "A" for exhibition purposes, or the carriage there of persons or property for hire or reward, and is flown to state "B" for exhibition purposes or for the carriage there of persons or property for hire or reward.

Aircraft belonging to the United States, states, territories, and possessions, and to political subdivisions, will be licensed if request for such action is made.

Rating of aircraft is made on the basis of airworthiness, which is dependent upon these factors:

A. The structural strength of wings, ailerons, tail surfaces, fuselage including engine mount, and landing gear.

B. Cockpit, cabin and control arrangements.

C. Power plant and power plant installation.

D. Equipment and instruments.

E. Propellers.

F. Fittings.

G. Materials and workmanship.

H. Flying characteristics and qualities.

Airplanes are classified according to gross weight in pounds, as

Class 1. Up to 2500.
Class 2. Over 2500 to 4500.
Class 3. Over 4500 to 7500.
Class 4. Over 7500 to 13,500.
Class 5. Over 13,500.

In specifying the airworthiness requirements, the Department of Commerce has determined such safety factors for wings, control surface and systems, fuselages, landing gear, and fittings as will eliminate danger from structural weakness in aircraft meeting these requirements.

APPROVED TYPE CERTIFICATE

To expedite licensing of airplanes, the Department has provided for the use of an approved-type certificate. This certificate will be issued to a manufacturer if the Secretary of Commerce approves his airplane design, which must be accompanied by full details of constructions, power plant, stress analysis, etc., and if the aircraft passes the prescribed flight tests.

After such a certificate has been issued, airplanes manufactured according to the approved type may be licensed, providing they pass the necessary flight tests, and are accompanied by the manufacturer's affidavit showing they have been built according to specifications in the application for the approved type certificate. This system will greatly reduce the amount of inspection required.

Airplanes already in use will be licensed if they are found to be of proper design, assembly, and workmanship, and of suitable materials and equipped according to the regulations, after passing the regular flight tests. These tests and examinations will be made by aeronautic inspectors of the Department, at such places and times as shall be specified by the Secretary of Commerce. An endeavor will be made to have these inspections take place at points most convenient for owners.

VIOLATIONS

Violations of the regulations may be penalized by revocation or suspension of the airmen's license, and imposition of civil penalties. Some of the specific causes for such action are:

A. Operation of aircraft requiring a license without the same, or in violation of the terms thereof.

B. Making false statement in application or information accompanying the application for the license, or in any report required under these regulations.

C. Equipping the airplane with a type of engine not specified in the license or approved by the Secretary of Commerce.

D. Remodeling the engine and using it to propel licensed aircraft without the aircraft having been first rerated as airworthy by the Secretary of Commerce.

E. Remodeling the airplane structure and flying the airplane without having it rerated as airworthy by the Secretary of Commerce.

F. Failing to make proper and seasonable reports.

The licensing of pilots and mechanics is fully as important as the licensing of aircraft. By the regulations, persons in command of licensed airplanes in flight must be licensed pilots, and persons repairing or adjusting licensed aircraft in flight, or in charge of ground inspection, overhauling, or repairing of licensed aircraft must be licensed mechanics. An exception to the latter

stipulation is that a workman or mechanic may engage in such repair work on licensed aircraft without being licensed if he does so under the supervision of a licensed mechanic.

REQUIREMENTS FOR PILOTS

Licensed pilots are classified as private and commercial pilots. Commercial pilots are further divided into groups, as transport pilots, limited commercial pilots, and industrial pilots. Transport pilots are qualified for all operations approved by the regulations. Limited commercial pilots are restricted to the carrying of persons and property for hire within a short distance of a specified airport or field. Industrial pilots are licensed for aerial photography, cotton dusting, etc., but may not carry passengers for hire. Licensed mechanics are classed as engine mechanics and airplane mechanics. A plurality of licenses may be held by one person.

The minimum age for industrial pilots, limited commercial pilots and transport pilots is eighteen years. The minimum age for private pilots is sixteen years. Industrial, limited commercial, and transport pilots must be citizens of the United States or of a foreign country granting similar privileges for United States citizens. Private pilots may be citizens of any country.

Up to December 31, 1927, the Department will approve applications for transport, limited commercial, and industrial pilots' licenses by pilots who have filed their first naturalization papers, and who meet all other requirements.

Before being licensed, transport pilots must have had one hundred hours of solo flying, of which at least five hours must have been within sixty days prior to the filing of the application. Before being licensed, industrial and limited commercial pilots must have had fifty hours of solo flying, of which at least five hours must have been within sixty days prior to the filing of the application.

Adequate physical examinations are required for licensing of all classes of pilots, with the greatest stress laid upon the qualifications for transport pilots and commercial pilots.

Transport pilots must pass examinations on the air traffic rules, practical and theoretical tests in elementary engine and plane mechanics and rigging, and a theoretical examination in the fundamentals of meteorology and air navigation. They must pass a practical flight test including landing close to a mark, with and without engine, figure-eight turns, emergency maneuvers, stalls, side slips, etc. Limited commercial pilots must pass similar examinations.

Industrial pilots must also pass an examination on air traffic rules and must pass the practical flight test prescribed for transport pilots, except that the distance for cross-country flight shall be sixty miles.

Private pilots must maneuver at 800 feet around two pylons or buoys 1500 feet apart, making a series of five figure-eight turns, and also must make three satisfactory landings to a full stop.

Times and places for examinations for pilots' licenses will be designated by the Secretary of Commerce. The examinations will be conducted by designated aeronautic inspectors of the Department of Commerce.

Unless sooner revoked, transport and limited pilots' licenses shall remain in force for six months and industrial and private pilots' licenses for one year. Renewals may be made when the applicant's physical condition has not changed, providing he has had at least ten hours of solo flying within the last sixty days if a transport pilot, at

least twenty-five hours within the last year if an industrial pilot, and at least ten hours in the last year if a private pilot. Provision is made for extensions, or securing new licenses if renewals are not possible under existing conditions.

MECHANICS' LICENSES

Mechanics' licenses are in force for two years, unless sooner suspended or revoked. Provision is made for renewals and extensions at the end of that time. Pilots' and mechanics' licenses will be suspended or revoked for:

A. Violating any provision of the Air Commerce Act of 1926 or these regulations.

B. Carelessness or inattention to duty.

C. Unsound physical condition, or any demonstration of incompetency in the operation or repair of aircraft.

D. Being under the influence, or using, or having personal possession of intoxicating liquor, cocaine, or other habit-forming drugs while on duty.

E. Refusal to exhibit license upon proper demand.

F. Violating air traffic rules.

AIRCRAFT LICENSE NUMBER REQUIRED

In order to carry out the regulations, and in particular to enforce the air traffic rules, both licensed and unlicensed aircraft are required to be identified by suitable license numbers or marks, as prescribed by the Department of Commerce. In other words, license numbers or identification marks must be shown by every civil aircraft, regardless of its use. Aircraft belonging to the United States government, and licensed airplanes engaged in racing or experimental work, will be assigned special numbers or symbols. For instance, the first airplane of the Department of Commerce was designated by the combination, *N-1*.

A licensed aircraft is identified by the license number which is assigned it. This number will be preceded by one of the following:

The Roman capital letter "C" (meaning commercial) for craft engaged in carrying persons or property for hire or reward, or United States mails, or in furtherance of a business.

The Roman capital letter "S" (meaning State) for craft used solely for governmental purposes and belonging to states, territories, possessions or municipalities.

The Roman capital letter "X" for licensed aircraft.

Unlicensed aircraft will be identified only by the number assigned it, and will in no case be preceded by a letter. Licensed airplanes in all cases bear a letter preceding the number so that distinguishing between licensed and unlicensed aircraft is a simple matter.

MARKS, SYMBOLS, DESCRIPTIONS

Identification marks for airplanes are placed on the lower surface of the lower left wing, and the upper surface of the upper right wing. The marks also are placed on both sides of the rudder. By special approval of the Secretary of Commerce other designs, marks, symbols or descriptions may be placed upon aircraft if they do not modify, or in any way impair, the visibility of the regular identification mark.

REQUIREMENTS IN OPERATION

The owner of an aircraft is charged with the continuous duty of maintaining it in a proper state of repair and flying condition after it is licensed, and between its government inspections for airworthiness. Violation of this duty will result in revocation of the aircraft license.

A general inspection of the control system, landing gear, main external

bracing, control surfaces, power plant, and propellers must be made at least once within each twenty-four hours preceding flight, and the results entered in a log under signature. After each one hundred hours of flight a periodic inspection must be made covering engine installation, control system throughout, propeller alignment, and fuselage, including fittings, tail skid, and tail shock absorbers. Department of Commerce inspectors must be permitted to inspect the aircraft at any time and place.

A licensed pilot must not carry passengers for hire or reward in an airplane or seaplane unless he has piloted an airplane or seaplane of that class for at least two hours within the last preceding ninety days, except when he makes practice flights in the airplane of such class for at least one-half hour, and takes it off and lands it at least ten times. Three of these landings must be to a full stop.

A transport or limited commercial pilot must not carry passengers for hire or reward at night unless he has had at least one hour of night solo flying within the last preceding thirty days, unless he makes a night practice flight of at least one-half hour with ten landings, three of which are to a full stop. Aircraft making such night flights must be equipped with approved landing and navigation lights, and also an approved signalling device.

Airplanes making cross-country flights of one hundred miles or more and aircraft operating over bodies of water beyond the sight of land must be equipped with a compass. In the latter instance, the airplane must be provided with food, water, lights, signal device, and life preservers or other approved flotation devices.

A seriously damaged licensed airplane must not be flown with passengers for hire or reward until fully repaired and its flying condition approved by an aeronautic inspector. Accidents to licensed aircraft and serious injury or death must be reported immediately to the Department of Commerce.

A complete navigation and engine log book must be kept for each aircraft. A navigation summary report made out in duplicate must be sent to the Department of Commerce every three months. This must cover the number of miles flown, the duration of use of each engine, engine installation and repairs, and the plane structure and rigging changes and repairs.

AIR TRAFFIC RULES

The air traffic rules detailed in the Air Regulations of the Department of Commerce must be obeyed by every aircraft flown over the United States, regardless of its class or the personnel operating it.

These traffic rules cover the following subjects:

1. Use of civil airways.
2. Giving way order and duties.
3. Crossing.
4. Approaching.
5. Overtaking.
6. Height over congested and other areas, and assemblies.
7. Acrobatic flying.
8. Dropping objects.
9. Operation of seaplanes on water.
10. Landing rules.
11. Lights.
12. Day marks.
13. Signals.

AIR NAVIGATION FACILITIES

The Department of Commerce has adopted a tentative program for rating airports and landing fields, which will be submitted by bulletin to all those interested in this matter. A period of time will be allowed for criticisms and

suggestions, after which regulations will be promulgated covering the entire subject. This rating will include facilities and night lighting equipment, in addition to size of the field and condition of the ground.

The rating will consist of three letters, the first to cover the general equipment, the second to indicate the night flying facilities, and the third to designate the size of the field and its safety for operators.

The highest rating will be "AAA." An airport, thus designated, will have all necessary equipment for operation by day and night, transportation and communication to the nearest city or town, quarters and meals on the field for visiting airmen, and will offer safe landing for at least 2500 feet in any direction, with clear approaches, or will have at least eight-way landing for 2500 feet, the landing strips or runways not to cross or converge at angles of less than forty-five degrees.

Coöperation between the public, aircraft operators, and the personnel charged with the administration and enforcement of these regulations will do much toward advancing the application of aircraft to commerce, industry, and recreation, all of which are of vital importance to national prosperity and security.

Two Sciences—Medical and Aeronautical

By Arthur La Roe, M.D.
Captain (Flight Surgeon), Medical Officers' Reserve Corps, United States Army

UNDOUBTEDLY to many, it will require a stretch of the imagination to consider the two sciences of medicine and aeronautics as having anything to do, the one with the other. There are, of course, certain indirect associations, as when the airplane evacuates the most seriously wounded from the zone of advance to a base hospital, far out of reach of even the longest range guns; or medical supplies are dispatched by air to detached commands; or, in civil life, the doctor is flown to his patient in some out-of-the-way place. Here, however, the one is merely making use of the other, just as big businesses do.

Relationship between These Sciences

But is there any direct relationship between medicine and the science of aeronautics? Has medicine anything of material aid to add to the advancement of aviation? A proper reply to these questions should prove highly interesting to those engaged in both activities, and to those laymen who have an interest in either the one or the other. Quite obviously medicine can add nothing to flying from the engineering aspect. What it has to offer has to do with the actual operation or practice of flying. It deals with the element of safety in the air.

In general the factor upon which the universal adoption of aviation by the public most largely depends is the factor of safety. Quite certainly if aviation were assuredly perfect from the standpoint of safety, it would be quickly accepted by the traveling public. The public entertains a certain skepticism regarding the extent to which this factor has been developed. This is evident from the nature of the reply so commonly made to an invitation to fly. "No, thank you, old chap, I'm sorry, but I have a really important engagement tomorrow," is a fairly typical one. The thought of aviation seems to bring to the lay mind an idea of sudden and violent death. Strangely enough, our human psychology being what it is, patronage is never denied the motor car because of its lack of this factor. And this in spite of its thirty to forty odd thousand fatalities annually in this country alone. One of my good friends, who resolutely repels every attempt at an approach on the subject of the air, is a reckless demon with his motor car. I feel that I take my life in my teeth when I ride with him. He really should fly. He would be much safer in the air, as would be also those poor mortals on the ground who are at his mercy when he drives.

Flying Is Safe

The public estimate of the relative safety and danger in flying is, as sometimes occurs, grossly in error. The factor of safety has already long since been brought up to a parity with the corresponding factor in other methods of transport, such as the motor car, the rails, and the vessels afloat. Undeniably aviation did pass through an exceedingly dangerous period during its developmental stage, as did also the motor car and the railroad train. The pioneers took terrible chances, and the

toll in human life has been great indeed. The sacrifice has not been wholly in vain, however. Flying today is about as safe as most of the other activities we engage in. This progress has resulted, first, from a consistent and steady development of the science of aeronautical engineering; and then from the application of the science of medicine to the practice of flying, in a study of the physical condition of the pilot and its relation to the safety of flying.

ANALYZING CASUALTIES

This matter of accidents in the air has received altogether too little of our attention. The public gives it none at all, except to read the harrowing details of the daily calamities that befall those foolish enough to risk their necks. Even within the industry itself, not enough care has been given to a proper analysis of these occurrences, and a searching for the causes with a view to their removal. The Royal Air Force (British), just before the close of the Great War, began a very interesting study to determine if possible what means might be employed to reduce the alarming number of casualties in its service. Something like four thousand cases were taken in which an analysis was possible. Naturally enough, a certain number are not amenable to analysis, as where there were no competent eye-witnesses, or all occupants of the ship were killed. These astounding results were announced. Two per cent were due to enemy gun fire; eight per cent were due to structural failure in the apparatus, either motor or plane; and ninety per cent were due to failure on the part of the pilot, either physical or mental. It is very interesting to note, too, that of these ninety per cent due to the pilot, seventy-five per cent were due to mental, or psychologic, and twenty-five per cent to physical disability or handicap.

In commercial use of the airplane we need not concern ourselves with the enemy's bullets and archie shells. The two per cent are thus eliminated. The eight per cent have been materially reduced by the progress in engineering. At the time when those statistics were made up it was a fairly common occurrence for a wing to fall off, a wooden propeller to fly apart, or a control mechanism to become jammed. Ships of the present day have been improved structurally to the point where these mishaps do not occur at all. In ships of current construction, failure in the air is utterly unknown. So much for the two per cent and the eight per cent. But what about the ninety per cent, those due to a failure either physically or psychologically on the part of the pilot? The science of engineering can do nothing about these, no more than it could build a Panama Canal until after medical science had eradicated the mosquito-born yellow fever. This is where medicine steps in to add more than a "bit" to the safety of this newest and most efficient method of fast transport.

How fascinating it would be in the light of the more recent medical knowledge in its relation to flying, to analyze some of the very early fatalities in flying, those of the period that preceded the rapid advances made in the art during the war. It has always been customary to ascribe all aerial accidents, the exact cause of which is unknown, to some failure in the machine. The press report runs something like this: "It is difficult to account for the accident, for Pilot So-and-So was an unusually skillful airman. It is quite certain that something went wrong with his machine." Now, according to these British figures, if by "his machine" is meant the human

machine, then the reports are correct in about ninety per cent of the cases. Unquestionably, many of our early flying men went to their deaths the result of some physical or mental handicap, which could have been discovered had flight surgeons existed at the time.

CLASSIFYING CASUALTIES

In all fairness to aviation, and in order to have a proper understanding of the actual circumstances, we should do more than merely analyze the casualties. We should classify them as well. It is not just to stigmatize all aviation because its most dangerous form is constantly at odds with the fates. One wouldn't discredit the motor car in general because of the recent accident in Wales, in which a racing man was killed while driving at 165 miles per hour in an experimental car of very high power. And yet we see in the news reports that a certain disaster has occurred in aviation, and jump to the conclusion that all flying is unsafe, without so much as considering that that particular mishap was in an experimental model that was hardly expected to qualify. We read constantly of the many fatalities in our military air services, and forget that these services are of necessity dangerous in their nature. It doesn't follow at all that because some young military fliers meet with disaster while they practise loops and turns in close military formation, or in mimic combat, that I will be unsafe as I fly from city to city in a passenger transport plane. And a great many of the accidents reported in these years just gone by are the direct result of flying in equipment not airworthy, but flying because there were no laws to prevent them from flying. Fortunately now in the new Air Commerce Act we have a means of guarding against the use of unairworthy equipment.

In this connection we should consider as an entirely separate group those accidents that occur directly as a result of meteorological conditions; cases where both pilot and ship were known to have been in perfect condition, but where the elements presented an insurmountable obstacle. The untimely death of Charles Ames of the Eastern Division, New York-Chicago Night Air Mail pilot, would probably be properly classified in this group. Ames was the victim of an impenetrable fog, a rapidly diminishing fuel supply, and a heroic determination not to sacrifice his ship by use of the parachute, along with a grim adherence to the tradition of his service to advance the mails. Similarly Lieutenant "Cy" Bettis of the army gave up his life in like circumstances. He failed by only a few feet to clear the top of a mountain hidden in a dense fog. His physical condition was excellent, and his ship one of the army's latest pursuit types.

AVIATION MEDICINE

In order to improve still further this element of safety in flying, to study these ninety some per cent of accidents that are due to the pilot's condition, a new branch of medicine has been developed during and since the Great War. A specialty within the science, now known as aviation medicine. The Army maintains a school for training physicians in this specialty on one of its largest training fields; the Navy has one in one of its base hospitals. The graduates are called flight surgeons. Their duties are first to select the cadets for training from among the applicants; then to care for them during the training and flying period; to "ground" them temporarily or permanently when a condition develops making further flying a hazard; and to restore them to flying status as

quickly as possible when temporarily grounded.

It is not within the scope of this paper to detail the course of study in aviation medicine. There is available a sizable text book on the subject. It will probably be of interest, however, to point out a few examples to show wherein the science of medicine has contributed to the safety of flying, and to show along what lines the flight surgeon works. It has been said that anyone who can drive a motor car can fly an airplane. To a certain extent this is true, but it is a dangerous generalization. All flying is not alike by any means. It is one matter simply to get a ship off the ground, sport around a little while, and bring it back. For sporting purposes and private use these ships are the acme of simplicity. Flying them is much simpler than is driving a car. No clutch, no gears, no brakes, possibly no instruments. And by far the keenest sport yet devised. If ever mere man is truly the lord of all he surveys, it is when he sits there with that joy stick in his hand. In the civilian course of flying that I took, that of the Curtiss Flying Services at Garden City, L. I., there have been several hundred civilians trained to fly since I first began visiting the field, and so far without a single failure to my knowledge. And in more than five hundred student fliers trained in seven years there has not yet been a single accident, even of a minor nature. This is one matter, however, simply to fly for a bit of sport now and then.

It is quite a different matter to take a combat ship out over the enemy lines, to fly above 20,000 feet, at speeds over 250 miles per hour, to watch more than a dozen instruments, to be upside down as much as right side up, to avoid collision with your comrades' planes, and to operate two machine guns against the dozen or the hundred enemy ships that are exhibiting the same consideration toward yourself. And it is still a different matter to take out the night mail every night at exactly 9.35 o'clock, quite regardless of the weather, and to fly through rain, and snow, and sleet, or fog. And possibly bear the responsibility for the lives of a dozen passengers as well.

Those who argue that all may fly, in order to demonstrate a certain universality in flying, fail to note that flying deals in three dimensions, whereas man is natively equipped to operate in but two. They fail again, and here grossly, to appreciate that all men, though they may be born free and even equal, are not born equally equipped with the various qualifications that enter into the various pursuits of man. And those pursuits that are the most recently developed find the least number of men equipped for them. Flying is probably the latest of man's acquisitions. Barring the fair-weather flying of sport, and considering only commercial and military flying as a business, it is far from true that any may fly. The fact is that very few may fly. In this sense flying requires a great number of qualities and traits, not any one of which is rare in the race, but all of which are found in only a few. Even in such a group as the cadets at West Point, or the midshipmen at Annapolis, far less than half can qualify for military flying. In the general public probably less than ten per cent could pass muster. Truly he must be a super-man who takes the responsibility of flying large groups of passengers through the dark and the storm, or of defending his country's honor in her first line of defense.

THE FLIGHT SURGEON AT WORK

The flight surgeon studies his man in every particular that may have a bearing on flying. He demands good

vision, not merely in the ordinary sense, that he must read small print at a certain distance. Many tests are applied to show, not what vision the man has, so much as what he may have under untoward conditions. For instance, there must be no possibility that the eyes, once in the air, will lose their balance, and fail to give the stereoscopic effect with which the pilot must judge his distance from the ground in making a landing. In the ears, he must possess not only good hearing, but perfect function in that delicate apparatus in the internal ear with which we determine our equilibrium. Three tiny little semicircular canals deep within each ear, lined with a delicate membrane, and filled with a fluid. The whole structure no larger than a hazelnut, yet how important to the passengers on an air liner those six little canals deep within the head of the pilot. And an ordinary cold in the head may markedly influence the function of these little organs. More than a few men have gone to their deaths because of some simple affair like this, that some flight surgeon might have warned them of if he had been available. And the time is coming when a flight surgeon will be required to "clear" every pilot carrying passengers on every flight. The flight surgeon is interested not so much in what is the blood pressure on the ground, as in what it is likely to be under altitude conditions. In the heart action, not so much as to its quality under examination, as what will be that quality under stress or the influence of severe emotional strain, as in fright, when the pilot suddenly discovers another ship dangerously close to his own in a fog. To faint under those circumstances would not be quite the proper thing for a pilot to do.

From the earliest period of man's evolution he has been called upon for a constantly increasing speed of nerve reaction. In this day of flying he is called upon for a reaction faster than has ever before been demanded. The flight surgeon splits a second into tenths, yes hundredths, in measuring the nerve-reaction-time of his subject. And only the very fastest are qualified. Suppose that two ships approach each other on a given line of flight, each traveling at 120 miles per hour, and in visibility of only a half mile. This gives seven and a half seconds for the pilot to see the danger, decide on his course of action, and carry it out. But visibility is not always of a half mile, speeds are not always so slow as two miles per minute, and then it takes an appreciable time for some ships to respond after the pilot has actuated the controls, and there is some slip or skid in the air as a medium. All of this reduces to considerably less than a single second the time that the pilot has in which to make the proper decision and act upon it. And yet many people have reaction times as slow as several seconds. Who would want to fly with one such?

Another interest of the flight surgeon, and one of paramount importance as shown by the British figures and our own experience, is the mental state of his prospective pilot; what psychologists call his personality make-up. How, in other words, his nerve system is put together. Solidly, so as to be unruffled even in greatly distracting circumstances, or slovenly, so as to go to shreds on the slightest provocation. The flight surgeon makes a psychoanalysis of his man, to determine, with what art he may, his adaptability to the varied stresses of flying. For, whatever of sport there may be in the fair-weather type of flying, there are in the business of flying stresses that the human economy, psychologically speaking, is not natu-

rally trained to withstand. Many of us live perilously close to the edge of mental breakdown, like the so-called shell shock cases of the war, many of whom never heard a shell explode. These were near the edge, and the stress of warfare pushed them over. The fact is, it is to be seriously doubted if any of us are very far from the edge, since we develop only as necessity requires. Flying with its demand for fast reactions, accurate judgments, its great penalties for failures, its terrific speed, its use of the additional dimension, its very intenseness—flying stresses anyone up to very near his limit, and only a super-man, psychologically speaking, can withstand the stresses of the most strenuous flying, such as the night mail, or military combat.

MEDICINE MAKES POSSIBLE THE CONQUERING OF THE AIR

In general there are two types of unfit, the one who under stress just quits and becomes sullen, morose, or even suicidal; the other who becomes excited and panicky and wants to break into pieces everything within his view. Obviously neither would make a good risk as a flier. I know of one case where a man quit his ship and took to his parachute merely because the engine wasn't functioning properly, in a place where there were plenty of available landing fields. He could have saved his ship. Another, where a man went mad with rage over a similar difficulty and dashed the ship into the ground, killing himself and another, and sparing but one of the occupants of the ship. And still another, where a man immediately after being advised that he was the victim of a dreaded disease, took off and dove straight into the ground with engine full out—plainly a case of suicide. All of these are cases where the dangers of aviation have been enlarged upon in the reports, and "something went wrong with the machine." The flight surgeon attempts to select his men with as nearly an even mental balance as possible. This is of necessity the least scientific and the most artful of his endeavors, and yet it is productive of highly valuable results when carried out with the proper authority.

Thus is the science of medicine, apparently entirely foreign to the science of aviation, lending its hand to the proper and safe development of this means of transport. Medicine made possible the building of the Panama Canal, and history is but repeating itself, as medicine makes possible the conquering of the highways of the air.

Aviation Insurance

By Charles H. Holland
President, the Independence Companies, Philadelphia

THE romantic history of transportation and the scarcely less interesting record of the development of insurance are curiously interwoven. For whenever man sought new means of covering distance he was faced by a multitude of hazards to himself and his property, calling for new ways of protecting his finances.

History of Transportation Insurance

The storm at sea, the hidden reef, and the other perils which beset the sailor were among the earliest of these transportation hazards, and probably the first known forms of insurance were the "bottomry bonds" placed on the small and primitive vessels which ventured into the Mediterranean.

Man progressed. He developed the steam engine to propel him over metal rails, and there arose the hazards of fog-hidden signals, and broken and washed-out tracks. Again the insurance system expanded to compensate man for personal injuries received in railroad wrecks and to safeguard his pocket-book when his goods were damaged or destroyed.

The automobile came and brought its own peculiar hazards. Automobile insurance thereupon was evolved in all its forms of protection against fire, theft, collision, property damage and liability. Insurance still kept abreast of man's endeavor to conquer space and time.

Latest of all, a new era in transportation began, when, one day in 1903, a crude, ungainly machine bumped along the top of a North Carolina hill, rose uncertainly in the air, soared for a few moments and then came back to earth. Man had begun to fly, but in the process soon discovered hazards heretofore undreamed of. As the airplane developed in utility and use, the need for protection against these hazards increased. This led to one of the most romantic chapters in the eventful history of insurance.

Until the time of the World War, the unfamiliar spectacle of an airplane in the sky caused excitement with all who saw it, but with the return of peace the new vehicle became the servant of commerce. Soon it was carrying mail across continents, and was beginning to be used for fast express package service as well as for passenger transport and special duties.

Even before the war underwriters began to consider the possibility of developing coverage for the risks of flying, a veritable insurance adventure hardly inferior to that of aviation itself. The first policy was written in England, in 1912, by Horatio Barber. However, the war put a check to thoughts along this line, and its close found the United States with hundreds of war planes, now idle, and many aviators who were anxious to find employment in flying. Thus there began an effort to develop commercial flying, and in 1919 there arose a sudden activity in aviation insurance on the part of eight or nine companies.

The main drawback was the timidity of the companies to grant aviation insurance. The result was that no one company accepted more than a very few of the lines of insurance required

by those engaged in aviation. At the same time, the limits of indemnity were, in many cases, insufficient to meet the requirements. The aircraft owner, therefore, in order to secure anything in the nature of comprehensive coverage had to obtain various policies from different quarters—some of these were foreign policies and there were gaps between the different coverages. The limits of indemnity were too low and in many cases the rates of premium very burdensome. This situation brought about conditions that bristled with difficulties for companies, agents and brokers, and aircraft owners.

Another drawback was the inexperience of most of the insurers. This led to the acceptance of many excessively hazardous risks from which large losses arose. It brought about higher rates of premium than would have been the case if more careful selection of risks had been employed.

ALL-IN-ONE AVIATION COVERAGE

It soon became apparent that conditions had not yet reached the stage of a sound underwriting proposition; the experiment proved costly to the insurance companies and was virtually discontinued. Meanwhile, the art of flying grew under the irresistible pressure of civilization's demand, although sadly hampered by the lack of coverage, and in the summer of 1926, an announcement of complete aviation coverage in one contract was made. This means that the hazards of fire, lightning transportation, accidental damage, theft, robbery and pilferage, public liability, passenger liability, property damage, tornado, cyclone and windstorm, are all covered in a single policy, which, if desired, may be accompanied by other policies dealing with personal accidents, cargo risks and compensation and employer's liability.

RATES

In undertaking to meet the insurance requirements of the aircraft industry, it was recognized that, for the present, rates must be largely a matter of judgment, there being little available experience upon which to base them. The underwriter must apply the skill and experience obtained by him from other classes of business, but so many new factors enter into the computation of equitable rates for insuring aircraft that no definite figure can be named to cover all risks, or even to cover any particular type of risk. This means, in other words, that each risk must be rated upon its individual merits. Therefore, in every transaction the age and type of plane and engine (with particular reference to the number of engines and the factor of safety with one or more not working), the fitness and experience of the pilot, the topography of the country, the purpose and length of the flight, the time flown, whether over established air routes having adequate landing fields sufficiently near together, and the question of night flying, all influence the judgment of the underwriter in arriving at a charge for the coverage.

Depreciation is a very important point by no means to be disregarded. Aircraft demands the best of care, together with frequent minor replacements as occasion requires. It is necessary that special attention be given to the motor, which needs to be taken down and overhauled after every 75 to 125 hours flight. If we can be guided by the prices set for used motors, the value of the engine should be written off after 150 or 200 hours of flight, unless it has been taken down and overhauled at such regular intervals. In the latter event, the average life may be increased to 500 hours, or more.

The extreme complication of such considerations as they affect the risk, and therefore the premium rates which should be charged, may easily be imagined. They make it quite evident why companies heretofore have been wary about taking chances in so unfamiliar a field. On the other hand, a certain element of public service is involved. The rapid development of aviation has an immense bearing upon the welfare of the country, and the insurance companies would fail unless they found means to raise from the aircraft industry the handicap of lack of protection.

Some coverage, it is true, has been written by foreign insurers, whose experience with this class of risks has been more extended than that of American companies; but clearly the business should make a strong growth on American soil, as has been the case with every other kind of insurance. Most of our states in their compensation laws require that the employees of aircraft companies, including the pilots, be protected by compensation insurance, and naturally a company undertaking this line would desire that there should go with it such other lines as it may write. Necessarily, a premium income for this class of business must be limited because of the infancy of aviation, and the principle of averages upon which all insurance is based cannot become effective unless the business be confined to comparatively few insurers.

If the business were to be distributed among a large number of companies, as is the case with other lines of insurance, a single loss sustained by any one company would disturb its average, and it is easy to conceive that the experience of most companies would be unfavorable, so that they would withdraw from the field and leave it without protection.

On the other hand, if the business is confined to a single company or to a small group, having as large a spread as the nature of the business will permit, an opportunity may be afforded for profit which would be reflected in the rates charged to the policyholders. Rates necessarily reflect experience, and companies should not write "freak" risks, because it would be an injustice to the aviation industry if companies whose planes are engaged in normal use were charged with losses that might occur under abnormal conditions. In other words, companies should endeavor to underwrite the business as conservatively as its nature permits, with a view to keeping down its cost and extending the range of its protection.

TYPES OF LOSSES COVERED

Paralleling, somewhat, automobile insurance, the modern aviation policy covers three types of loss. First, loss to the plane itself; second, injury or damage to persons or property in the plane; and third, injury or damage to persons or property outside of the plane.

In the first group the hazards covered are those of fire, theft, windstorm and accidental damage. The inherent fire hazards in a plane are very similar to those found in an automobile, the main difference being that when a plane catches fire it is seldom within a short distance of a fire house, as an automobile may be. Few planes are stolen, although the papers last summer carried the story of two which were taken from their "parking place" in an open field. However, as knowledge of airplane operation becomes more widespread, and the market for used planes and parts increases, the theft coverage will doubtless become an important one.

Windstorm coverage applies to dam-

age suffered by the plane when the hangar in which it is housed is struck by the wind in such a way as to harm the plane. If the plane is aloft and the wind damages some part of it so that it makes a forced landing and is injured, it is covered by the accidental damage clause, which protects the owner against loss from a wide variety of contingencies.

In the second group of hazards, those which threaten injury or damage to people or property in the plane, we find such specific coverages as passenger liability and, in additional policies, cargo risks, personal accident and compensation, and employer's liability. The passenger liability coverage is an important one, as an injured passenger might bring suit against the company operating the plane in a ruinously large amount.

The coverage of cargo risks protects the plane owner or the shipper against loss or damage to any goods being transported, or the common carrier against his legal liability therefor. Personal accident coverage may be taken out by the pilot and passengers to cover them in case of injuries. This is particularly important inasmuch as there are few life and accident policies which will cover an aviator. Compensation and employer's liability insurance should be taken out by companies operating airplane fleets to protect themselves when pilots or ground men in their employ are injured in the course of their duties. In most states, employers are compelled by law to carry compensation coverage, but whether required to do so or not few employers care to assume the burden of paying compensation claims out of their own pockets, and the coverage is therefore a popular one in large outfits.

The third type of coverages, those which insure against injury or damage to persons or property outside of the plane, includes two clauses, public liability and property damage.

There is almost no limit to the amount in which one can be sued for injury to a person. Anyone who has watched the trend of verdicts in liability suits against motorists must realize that juries are inclined to render verdicts stipulating immense damages. The public liability coverage is, therefore, one of imperative necessity.

When a plane runs amuck, any property it strikes in the process is going to be rather severely damaged, and insurance to pay for that damage and any suits arising therefrom is an important adjunct to complete insurance protection for airplanes.

Foreign companies—mainly Lloyd's organizations—have insured aircraft under policy forms and conditions which may be well understood abroad, and interpreted by foreign courts, but which are not in line with American methods. The companies now writing aviation insurance have prepared policy contracts predicated upon the well-established conditions of the fire insurance contract prescribed by the various states, and the standard automobile policy, so that most of the policy provisions already have been interpreted by the courts and little room is left for misunderstanding as to what the coverage actually is. The form, however, is elastic, and may be broadened by endorsements as occasion requires.

The aviation business of the companies writing this class of coverage is handled principally through special departments. Some of their underwriters are experienced aviation engineers who are well qualified to offer advice to policyholders having in view increased safety. The companies have built up an inspection and adjustment organizations in keeping with the requirements of their policyholders, and

have developed a very comprehensive classification system, whereby all aircraft business is classified according to the coverage written, subdivided under type of use and plane. The losses also are classified according to the cause, but with a subdivision as to the experience of the pilot.

CAUSES OF LOSS

Aircraft accidents are seldom ever due to a single cause: usually several factors are involved, among which may be mentioned structural defects, engine trouble, lack of fuel, weather conditions, error in judgment, physical illness, fatigue and mental confusion. If only one of these factors influenced the situation the aircraft could usually be brought to a safe landing, but if, in the case of engine trouble, the pilot becomes confused and does something he should not do, or if his judgment is poor in an emergency, the result may be serious.

The experiences of the German Aviation Pool show the majority of the serious losses to be the result of engine failure, and starting and landing accidents, which together accounted for 77.5 per cent of the total number of accidents in 1923, 85.7 per cent in 1924, and 68 per cent in 1925. From this same source we note that of 106 aircraft insured in 1925, losses were sustained on 58. The Directory of Civil Aviation in England estimated that within the past year landing accidents in that country amounted to about 25 per cent, engine failure about 25 per cent, and weather conditions about 50 per cent.

The foregoing statistics show the importance of having the very best type of pilot obtainable—one who is physically, morally, and mentally fit and in every way competent.

The working safety of aircraft engines has not yet been satisfactorily solved, from an insurance standpoint. The ground organizations of the civil aviation companies still leave much to be desired. Salvage surveys and repairs in cases of damage still involve disproportionately high costs and difficulties. The enormous demand upon the nerves of the pilot is a very important factor in underwriting. Adverse weather conditions is a serious enemy of aviation. Starting and landing maneuvers (especially in case of forced landing) are not yet executed with the desired precision. Many difficulties remain to be overcome, such as adequate ground forces, repair and salvage forces, etc. The cost of repairs is very high, and almost impossible at any price in isolated portions of the country. Insurance can make a more rapid advance only when the facilities of landing fields and repair shops are scattered at more frequent intervals along the main air routes.

The "Air Commerce Regulations" recently adopted by the Department of Commerce (Aeronautics Branch), having to do with the licensing of aircraft, identification marks, requirements in operation, licensing of pilots and mechanics, and air traffic rules, will have much to do in improving underwriting conditions. The necessity of a register of aircraft similar to Lloyds' Register of Shipping is recognized.

Errors in judgment are perhaps the most common cause of aircraft accidents. The pilot may misjudge his distance from the ground when landing, and flatten out too soon or too late; he may bank too much or too little; he may attempt to turn too near the ground and side-slip. A good pilot must subconsciously react quickly to counteract a sudden emergency in which he is placed. A fraction of a second may determine safety or a crash. Fatigue is a common cause for failure of the brain to respond promptly to an emergency. Fear does not occupy the

important position sometimes accorded it, as a pilot has little time to think of danger during flight.

Naturally, as a result of the progress in perfecting aircraft construction, accidents are not caused as frequently today through the failure of some vital part of the plane as formerly. Careful inspection of the entire aircraft, however, is still most essential before attempting to take a machine off the ground. An aircraft is subject during flight to such severe strains and vibration that defects are sure to develop after any extended flight.

It is not uncommon for a plane to catch fire in the air. The chief causes are a defective gasoline feed system; the accumulation of inflammable vapors; gasoline, dirt or oil about the engine or manifold, which may become ignited through overheating or a spark. The danger from fire is most serious when a crash occurs resulting in the bursting or puncturing of gasoline tanks or supply pipes.

EFFECT OF PROTECTION ON FLYING

I have traced the history of insurance and transportation and examined, briefly, the various forms of aviation coverage; the next question is, naturally, what effect, if any, will this insurance protection have upon the development of flying.

The few months which have passed since the announcement of complete aviation coverage have not sufficed to show any marked change in the status of the airplane, but certain predictions may be made, which, because of past experience and present indications, are practically certain of fulfillment.

Large express companies, which had heretofore hesitated to utilize the airplane for the delivery of rush goods, are now planning to buy large fleets of planes and send them all over the country, safe in the assurance that each one is fully underwritten. The government will doubtless find more and more private interests willing to lease and operate air mail routes. A case in point is the Boehing Airplane Company, which is to operate an air mail route in the West.

It is not surprising that insurance should have a strong bolstering effect on aviation. There is scarcely a business today which would not collapse if the supporting framework of insurance were withdrawn from it. Insurance to the individual means protection against monetary loss; to an industry it means a firm credit basis, an assurance of immunity from the ravages which chance mishap can impose.

Recently, the editor of one of America's greatest aviation trade journals made the following statement:

> With the announcement of an insurance policy that would cover every risk in aeronautics the foundation of successful commercial aviation in America was laid. One of the causes retarding its growth has been the failure to secure insurance at a cost that would warrant complete coverage and without insurance it was impossible to establish the confidence necessary to encourage investment.
>
> In the transaction of business, credit is essential. It is mutual confidence organized. There are two pre-eminent attributes which inspire financial confidence in men and organizatioms—"what they are" and "what they have"—otherwise known as "character" and "collateral." These are the high C's of business—without them, credit cannot exist.
>
> Insurance will establish confidence in aviation and insure a liberal amount of available loan for development. Heretofore, well-organized air plans failed in the majority of cases due to their inability to secure proper financing.

That the leading airplane manufacturers of America are thinking along the same line may be seen from reading the following excerpt from an article

written by Thomas H. Huff, President of the Huff Daland Airplane, Inc.:

> Above everything else the airplane at the present moment needs public confidence. Directly through the application of insurance to aeronautics will come public recognition of the safety of air travel. There will be an increasing demand on the part of business executives to use aircraft when they know that it is possible to insure the plane against loss or damage. Such insurance will have a far-reaching effect on the application of airplanes to commerce. Companies operating airplanes over large territories will have the assurance that their capital investment is protected.

A few years ago, the day when private planes would be owned by individuals was regarded as a purely visionary period; now, that day seems almost upon us. Naturally, individual ownership of planes will mean that each plane owner will require full protection against fire, theft, crash, and other contingencies.

WHAT PRACTICAL AIRMEN THINK OF IT

One could scarcely close a discussion of aviation insurance without making mention of the attitude of the practical airman towards it. Lieutenant George O. Noville, Flight Engineer of the Byrd North Pole Expedition, Supply Engineer of the Around-the-World Flyers, and recently selected to accompany Lieutenant Byrd on his proposed New York-to-Paris flight next summer, made this statement recently: "I have felt for a considerable time the necessity of adequate insurance as a means of permanently establishing commercial aviation in the United States."

That sentence indicates that aviation insurance is as enthusiastically regarded from the cockpit as it is from the swivel-chair.

Standing at the threshold of an age of limitless possibilities, there is the temptation to let one's imagination play with the coming rush of airplanes, which seems destined to transform our social and economic conditions. Scarcely less fascinating is the desire to foresee something of the vast possibilities of aviation insurance, and to feel that one may have had an opportunity to contribute in some degree to its pioneering. Insurance companies are "taking off" on a glorious adventure in aviation insurance.

Aircraft Merchandising Plans of the Alexander Aircraft Company

By J. Don Alexander, President

SOME fifteen months ago we of the Alexander Industries began construction of a new light commercial airplane.

The new ship's performance was exceptional and the price quoted in Denver was less than the manufacturer's cost on the first fifty produced. Therefore, as Emerson once said, "the world should have made a beaten path to" the manufacturer's door. But careful and expectant watching showed no signs of such a movement. We soon saw that we would have to carefully survey the path, pave it, and put signposts up along its course before the public would even look in this very right direction.

How to do this? That was the question.

We of the Alexander Company, searching for precedents which would be of value in the merchandising of this plane, could find none. Competitive manufacturers never had found a sales plan necessary because their small output had been gobbled up by a hungry market before the paint was dry on it.

Their methods, however, did not interest us. One-a-month, one-a-week production did not interest us. One-a-day production had significance for us only as a stepping-stone which would carry us a little nearer to one-an-hour production, or even—well, we have all read about Ford's four cars a minute (or is it sixty?) and the hardest head may have its dreams.

We believe in the United States and we believe in aviation. Put these two beliefs together, shake well, and then guess what we expect American aviation to amount to in the future. So we studied out a way.

It seemed apparent that the most effectual way to make the American public air-minded would be to get the people who compose it into the air, and there show them that flying is safe, efficient, economical, and highly enjoyable. Having come to this conclusion we had, so to speak, surveyed the route that much-to-be-desired path to big production must follow.

Convincing the Public

The first process in the actual construction of the path was the process of proving to the public the falsity of the general impression that piloting an airplane is a superman's job. Supermen are and always will be scarce. If none but supermen could run airplanes the world's total manufacture of aircraft would not need to be much more than one a generation. The hat industry would not amount to much if hats were worn only by such human beings as have heads the size of Daniel Webster's.

That notion that all pilots must be supermen was planted in the public's mind by stories about war-time flying, which necessarily is dangerous and full of such unexpected episodes as require a vast ability to meet terribly critical emergencies. After the war was over, finding that this traditional glory automatically fell on them, commercial aviators grinned and nodded. You cannot blame any human being for

accepting public adulation, reverence, respect. Is there, or has there ever been, one who would not like to be regarded as a hero? What mere creature in pants and goggles can seriously protest and say, "Nonsense, it isn't true," when a pretty girl or an admiring boy, looks at him with awe and brings against him the splendid charge that he is gloriously brave?

But such a public mental attitude, it must be admitted, is very far from one which will accept the safety of flying. Even when such supermen declared flying to be safe the general attitude naturally was that they were being modest.

SELLING ORGANIZATION

Our first task, therefore, was to form a selling organization made up of district dealers with exclusive sales rights in protected territories. This plan was similar to the ordinary competitive dealer organization but varied from it slightly.

The ordinary competitive contract requires the dealer to purchase a certain number of planes for his territory, regardless of his ability to sell them there. Our plan requires that a demonstrator Eaglerock shall be in use or ready for use at all times in the dealer's field, and we recommend that with this plane he shall offer to train students. We know that this will help him sell our planes while, at the same time, increasing general interest in aviation. In other words the question which we ask him is not, "How many ships can you sell?," but, "How many ships can we help you sell?"

After we had fixed this idea firmly in our own minds and those of our dealers, we began upon the task of selling to our dealers the idea of so lowering their instruction and passenger-carrying rates as to make them interesting to the public. Prohibitive prices have killed many a good idea and are among the influences which have handicapped American aviation. But rates can be established which will seem reasonable to the public and remain high enough to yield a dealer profit. As volume of business increases these rates can be lowered further to the dealer's increased profit.

INSTRUCTION

At our own airport we established an experimental school offering instruction at ten dollars an hour, a reduction of half to two-thirds of the established rates. This procedure caused quite a furor among the flying fraternity, some but by no means all of the comment being just a bit (or even quite a lot) resentful.

We then established a passenger-rate of one cent a pound for short joy-hops and very quickly proved, at least to our own organization, that volume of business at fair prices pays. This also had a lesson in it for our dealers: that a machine must be used steadily if it is to yield a profit.

We further argued to ourselves and them that even though the rates for student instruction and passenger carrying were net cost, they really would yield a profit if they resulted in increase of sales.

In order to put this thought over with the dealers we directed their attention to the free demonstration and instruction work done by automobile dealers, typewriter manufacturers, and others, and showed that in these tremendous and growing businesses such methods are considered essential to success.

We cheerfully admit that an aviation school or commercial operator cannot make money at the suggested rates if dependence is solely upon such business. But our methods surely have roused interest, which of itself is

worthwhile, and where they have involved actual competition on our part with established schools, we have, in most instances, recommended to the applicant pupil that he take his instruction from his local school. Thus we have given to various schools business that they scarcely would have secured without us, and, in addition, have stimulated general interest in aviation, helping all schools.

As our production has increased we have steadily enlarged our advertising campaign, and today the flying fraternity is familiar with, and sold upon, our product.

PURCHASE PLANS

We learned that approximately 5000 commercial flyers, naturally anxious to fly new production jobs, were prevented by high cash prices from so doing, and, therefore, were flying inferior war-surplus ships purchaseable at one-fourth to one-quarter the price of our new ships. We studied this situation carefully.

Presently we learned that a pilot and ship engaged in commercial work should do an annual gross business of five to ten times the cost of equipment. It was obvious, therefore, that a market was ripe for sales if we could find a way whereby such pilots could buy new ships from us upon the payment plan.

It is necessary for a pilot to invest with us, at the start, only thirty per cent of the cost price of his ship, if he decides that a larger cash payment will be a handicap upon him. This enables a pilot, if he is of the right sort, to get a new ship with the same cash-payment that a war-surplus ship would cost him, and let the ship pay for itself, thereafter, out of the increased earnings which it will make over an obsolete war-surplus machine. This time payment plan is available to qualified pilots and takes good care of them.

REPRESENTATIVES

To interest the non-flying public our dealers, backed by all the help that the home office of the company can give them, appoint sub-dealers and representatives throughout their territories and this gives us accredited agents (representatives) in each city and village of the nation. Sub-dealers must be flyers and must each keep a demonstrator ready for operation. Representatives are not necessarily flyers and need not maintain demonstrator machines, but each must be equipped with a model and other sales material and report progress, from time to time, to the dealer and the Denver headquarters. Representatives are paid commission on the sale of planes, student instruction fees, and passenger flight returns, and are expected to boost commercial aviation whenever that is possible.

We have no difficulty in finding representatives. At least one young man intensely interested in aviation is in every town of the United States. A surprising number so far have been unable to attach themselves to the new art and industry. Such young men eagerly welcome the opportunity to become one of our representatives, for it offers for the future the chance of becoming a flyer, a mechanic, or a salesman.

We supply such a man the best of material to enable him to talk up aviation to his townsmen; the model airplane adds an attractive item to his equipment and enables him to make a real local display.

This display always attracts much local attention and draws many to the representative with questions which study of our instructive literature has fully equipped him to answer. To live

prospects such a representative will give catalogues and copies of *The Aircrafter*, our house-organ, which we distribute monthly to air-minded friends.

For our definite purpose of helping we have our sales manual, our sales course, a ring-binder containing photographs of construction details, dealers' weekly bulletins, suggestions on merchandising, methods of follow-up on prospects, and model sales-letters.

On demand we will send flying salesmen from the home office. We will plan and help coöperation with chambers of commerce and manual training schools. We supply motion-picture playlets featuring the safety of flying. We suggest and direct student instruction. We do national advertising in aeronautical publications and other mediums. We keep in close contact with all sales publications and give our whole force the benefit of this.

ADVANTAGES SET FORTH

We have determined to bring the advantages of airplane use to the American businessman's attention and are succeeding in this effort, as is instanced by the fact that five recent sales of planes were to non-flying businessmen convinced that planes will help them in their enterprise.

We recently surprised competitors by paying for a series of advertisements of their products in an aeronautical periodical. We feel that each new ship sold, of whatever make, boosts commercial aviation and that that reacts to our advantage. The more sales our competitors may make the better we shall be pleased.

We find among the youth of this country an encouraging interest in the conquest of the air. Question your son or any boy from the age of ten to that of twenty and you will feel ashamed of your own lack of aeronautical information. Every youngster of the present day has the same desire to someday own an airplane as the youth of the last generation had to someday own an automobile.

A worth-while message to American businessmen is: The next time you get a chance take a ride in an airplane. A feeling of comfortable safety will quickly substitute that fear you will probably expect. The pleasure and the comfort of this means of travel will be revelations to you.

Clearing the Air for Commerce

By W. Jefferson Davis

Lieutenant-Colonel, Reserve Officers Corps. Formerly War Department Legal Advisor in Europe[1]

THE American Congress has at last underwritten the "fourth estate" of transportation. It has written the Bill of Rights of the new commerce—the commerce of the air. The legislation was rather belated, but now that it is on the statute books, it atones, partially, for the legislative laggardness of the past, and offers to American capital virtually an uncharted field as limitless as the skies.

The Air Commerce Act of 1926

There is no popular conception as yet of the scope and potentiality of the "Air Commerce Act of 1926," known before its passage by Congress, and approval by President Coolidge, as the Bingham-Parker Bill. This act put the government to the task of encouraging and developing commercial aviation, but without the intervention of a direct government subsidy. Our government has shied rather consistently fron direct subsidies, although European nations are not so aloof.

But it must be admitted that European nations, although they did not invent the airplane, have outstripped the United States in its utilization. Their passenger, freight, and air mail lines in operation today demonstrate that fact.

That we are a pioneer, yet a novice, in this game of aerial transportation may be illustrated in a paragraph. While Europe has been carrying on intensively in the air of commerce, our activities mainly have been confined to a few air mail routes, none of them self-sustaining. Practically no mail route is self-sustaining, whether a rural delivery or an overland express, but the O. K. of Uncle Sam on an aerial mail delivery route presumably should bring enough "side business," if you want to call it that, to make the whole project pay.

But the trouble has been that prior to the legislation just enacted, the whole system of transportation by air in the United States has been on the "stagger stop" basis. After having invented the airplane, America sidetracked it, and left it in an orphanage hangar. Only when she saw her child on parade, in charge of a foreign nurse within the past year or so, did the mother country grow jealous.

Then came the Bingham-Parker Bill, and the resultant Air Commerce Act, after the Senate and House differances had been adjusted. It is the greatest step toward the full development of American transportation since the passage of the Interstate Commerce Act, creating the Interstate Commerce Commission, and the National Good Roads Law of 1916, which has made automobile travel a soft-cushioned pilgrimage rather than a shake, a shiver, and a detour.

The Interstate Commerce Commission today not only regulates interstate transportation by railroads—the common carriers which were granted certain government subsidies in their earlier days, as commercial aviation

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now must receive direct or indirect government aid—but the travel by motor busses has reached such interstate proportions that the Commission recently has taken cognizance of this means of transportation on land.

It scarcely intrigues the imagination of any American, and it does not conscript the foresight of a Jules Verne, to visualize the time when air transportation will be so vital to the nation's defense and its commerce, that there must be created a government body which possibly will be known as the "Interstate Air Commerce Commission."

No one commission, assuredly, could encompass in its regulatory authority the network of American railroads, motor busses and thousands of airplanes, passenger, mail, and freight, flying in the never-never land of the air.

The Bingham-Parker Bill, approved by President Coolidge near the close of the last session of Congress, is a far-reaching step toward the encouragement, rather than the subsidization, of commercial aviation in the United States. If there is subsidy in it, the disguise is so excellent that even the ancient enemies of a "ship subsidy" in the Senate and House didn't smell the essence of danger in the air. Indeed, there is no danger. Today our country probably is the only recalcitrant among the more important countries, which concerns itself about subsidies to the real transportation of the immediate future.

The United States has never subscribed to the Prague Air Code, nor the basic principles of the International Air Navigation Convention of 1919, yet many of their fundamental principles must be utilized in connection with the regulations which the Department of Commerce has issued following the passage of the Air Commerce Act.

The new law gives the business of commercial aviation a legal standing—something it has never had. It provides a uniform system for the licensing of pilots and planes. Even the "gypsy" aviator, who flies from one state fair to another, and takes up passengers for "the thrill which comes once in a lifetime," is made amenable to the new code of the air.

In effect, the Department of Commerce will supervise airplane routes, permits and flights as much as it controls today the licensing of steamboats and the regulation of radio.

"Let Hoover do it," has been a sort of "buck-passing" by-word during both the Harding and the Coolidge administrations. Secretary Hoover, known as the Secretary of Commerce, has broad shoulders, and he never shrugs nor droops them when a new job comes along.

Under the legislation recently approved by Congress, the Secretary of Commerce is given "the duty" of fostering air commerce in accordance with the Act, and, among other things:

To encourage the establishment of airports, civil airways, and other air navigation facilities.

To make recommendations to the Department of Agriculture as to necessary weather service.

To study the possibilities of the development of air service; to advise with the Bureau of Standards and other government agencies; to investigate and report on aerial accidents; to provide for the registration of aircraft as to their air-worthiness; to provide for the periodic examination and rating of airmen serving in connection with aircraft of the United States; to provide for and establish traffic rules for the navigation, protection, and identification of aircraft, including rules as to safe altitudes of flight, and rules for prevention of collisions between vessels and aircraft.

In other words, the new aircraft inspection and regulatory law is as

comprehensive as existing statutes, giving the Secretary of Commerce authority to make inspections of steamboats, and to issue or revoke licenses therefor, or the law giving this same Secretary control of the wave lengths in radio communication. Many kinks are to be straightened out, but a decided step both toward federal regulation and federal aid has been made. That these rather haphazard requirements, enacted by Congress in a general treatment of a comparatively new subject, must be fitted into the law of the nations, as proposed in a convention which this government has never yet ratified, is as inevitable as that the states fell into line a decade ago when the first Federal Good Roads Law was put on the statute books.

REGULATION OF THE AIR

Among constitutional lawyers who have given careful thought to the jurisdiction of the air, there seems to be no question but that the sovereignty in each nation over the air space above its territory is the only theory which will promote the proper development of civil aeronautics. The one greatest need of American aviation has been federal legislation.

We have had no laws governing aviation. Airplanes until now have had the distinction of being about the only thing in America that have not been legislated either for or against. This new bird of sport and commerce has been a legal orphan. It has had an uneasy feeling that there must be some laws that govern it somewhere; but where and what it has not known.

We have reached the stage in the development of aeronautics where the air becomes transportation's "fourth estate." Transportation by land, by water, by rail, and through the air must each in some respect be regulated in different ways. We have passed through the development of national highways, waterways, and now railroads in turn must give way to transportation by air. Aeronautics is largely the development of war, but Congress was faced with the immediate necessity of enacting federal legislation providing for uniform air laws. The Aviation Committee of the American Bar Association has been urging on Congress for years the necessity of legislation defining the rights, and fixing the responsibilities of this strange new activity. But Congress neglected it, not because there was any intelligent objection to it, but for the same reason that a man carrying a load in the snow does not stop to make a sled—he can plow along in the old track without having to put his mind on a new device.

The American Bar Association, at its annual meeting in Cincinnati in 1921, after hearing the report of its Aviation Committee, recommended that its members give their attention to fundamental problems of jurisprudence involved in the proper solution of the demands of aeronautics. Since then numerous bills have been pending in Congress. One of these, the Civil Aeronautics Act of 1923, had the endorsement of every department of the government and was also recommended by the President, and yet it, like all its predecessors, died in that national slaughter of the innocents in the closing days of Congress.

Advocates sponsoring civil aeronautical legislation caused the introduction of bills early in the 69th Congress which were passed by the Senate and House, referred to conferees appointed by the House and the Senate to consider differences growing out of amendments proposed by the House Committee on Interstate and Foreign Commerce, and the conferees' report was adopted by both houses of Congress, and the bill signed by President

Coolidge on May 20, 1926. Thus ends the concerted efforts which have been made by the American Bar Association since its attention was first called to the subject of legislation governing air navigation by a resolution offered in 1911 by Governor Simion E. Baldwin of Connecticut. Governor Baldwin's resolution provided that Congress, under its powers as to commerce, can, and should, regulate by statute flights in the air between states, or between the United States and foreign lands, or our territories of the United States.

THE CONNECTICUT LAW

The American Bar Association, unconvinced at that time as to the necessity for air legislation, failed to take definite action on the subject, but Judge Baldwin, as governor of Connecticut, secured the passage by the legislature of that state of a bill drafted along the lines suggested in the resolution, which he had previously offered before the American Bar Association, with the result that the Connecticut Act of 1911 was the first measure adopted in America regulating aviation. The Connecticut statute is significant in that it marks a distinct departure from the common law theory of negligence.

Transportation through the air has to contend with a natural force—the force of gravity. If an aircraft falls and a wreck occurs, injury is apt to result to person or property. In the opinion of Governor Baldwin, and according to the present Connecticut law, the owner of an aircraft causing such damage is liable to the injured party in damages, although proper care and skill have been exercised.

Some fifteen years after the pioneer legislative recommendation of Governor Baldwin another Connecticut statesman, himself a former governor, steered through the United States Senate the Bingham-Parker Aviation Bill, now the Air Commerce Act of 1926. He was Senator Hiram Bingham, aviator and instructor in flying during the World War. Senator Bingham was a member of the Morrow Aircraft Investigating Board, appointed by President Coolidge in the fall of 1925, and headed by Dwight F. Morrow, of New York.

Action was taken by the American Bar Association in 1920 when it appointed a special Committee on the Law of Aeronautics, and so important has been the work of this committee that the American Bar Association, at its meeting this year in Denver, created a permanent Committee on Air Law, enlarging its duties to cover the subject of the law pertaining to aeronautics, radio and other uses of the air. The Association further authorized its Committee on Air Law to tender its services to the Secretary of Commerce to assist in drafting regulations under the new Air Commerce Act. It can readily be seen that important powers will be lodged in the Secretary of Commerce, and that such regulations will guide and direct our federal government and the individual states on the question of sovereignty which they should, and will, exert over the air.

THE NEED FOR FEDERAL LAWS

The need of federal air laws is most obvious. First and most important, to give the business of commercial aviation a legal standing.

It used to be that big business went ahead first, and had laws cut to fit it afterwards. But not any more. These days investments wait on clearly defined legal rights. Even the Standard Oil Company in this good year of our Lord 1927 won't buy a rich oil field until every Indian heir to the third generation signs a quitclaim deed. If you approach a Man of Millions with

the most assured prospect of twenty per cent, he will not budge a dime's worth until he knows what standing the thing will have in the courts.

That is why it has been so difficult to organize commercial aviation companies. Our mechanics have proved they can make the machines. Our pilots can fly them over any obstacles, in the teeth of any weather. Our aircrafts have successfully demonstrated they can carry passengers and mail and express and freight, and do it with a swiftness and sureness that mean incredible savings.

But years have passed, and still our big aviation companies are merely in the "perhaps-before-long" stage. This situation is largely because we have had no legal basis upon which to organize such companies. There have been no laws defining their rights to acquire property in landing fields; no regulations regarding the licensing of pilots, or the inspection of planes; no statutes defining responsibility for loss in case of accidents.

Obviously these matters cannot be left to states and cities. Nothing could have been more disastrous to aviation than a set of conflicting local laws. Flying is so obviously an interstate affair that federal legislation is absolutely required. And it is on the theory that Congress has the power to regulate "commerce with foreign nations and among the several states" that Congress found its authorization for the enactment of the Air Commerce Act. The Supreme Court of the United States has construed commerce as a unit which does not require state laws, and while under the Constitution, strictly speaking, both interstate and intrastate commerce are incidentally subject to regulations by different sovereignties, which as Mr. Chief Justice Taft has recently clearly enunciated, when interstate and intrastate commerce are so mingled together with the superior authority, the nation cannot exercise effective control over interstate commerce without incidentally regulating intrastate commerce, such incidental regulation is not an invasion of state authority.

It has, therefore, come to be recognized by leading constitutional authorities throughout the country, that the uniform regulation of aeronautics is absolutely indispensable to the development of air transportation as an instrumentality of interstate commerce.

The Supreme Court of the United States has also held that the power to regulate commerce is not confined to the regulation of instrumentalities known or in use when the Constitution was adopted, but such power keeps pace with the progress of the country, and adapts itself to the many developments of time and circumstances.

To the business man who has capital to invest in an aeronautical enterprise, three questions are important. First, what are an aviator's rights? Second, what are his liabilities? Third, what agencies have the power to regulate aeronautics and to what extent?

It is in answer to these questions, which would naturally arise in the minds of investors, that federal legislation has been enacted.

LAWS ABROAD

We have lagged far behind European countries in the development of air law. For they not only have national laws governing and stimulating aviation, but the sixteen most important foreign countries have adopted the International Air Code which was formulated at the Prague Congress. We also have the experience of European countries which has already found expression in the International Air Navigation Convention, so far as regulations governing aircraft are concerned.

As early as 1910 an international convention was called in Paris for the purpose of framing a proposed International Convention on Air Navigation. The results of this conference were of little value in solving problems affecting the jurisprudence of aeronautics, because it was found impossible for the convention to agree on fundamental principles involved.

In 1919, at the invitation of the French Premier, delegates representing sixteen of the allied powers again met in Paris for the purpose of drafting an International Convention on Air Navigation. The commission was composed of the following delegates: two representatives from each of the principal powers, United States of America, British Empire, France, Italy and Japan; one representative from Belgium, Brazil, Cuba, Greece, Portugal, Roumania, and Servia.

The convention, which was originally organized for the purpose of drafting the International Convention on Air Navigation, later became the Aeronautical Commission, charged with the duty of advising the Supreme Council of the Peace Conference on aeronautical matters. Underlying the general principles agreed upon by the convention, the basic principle involved in the International Convention on Air Navigation is that the contracting states recognize the exclusive sovereignty which each nation has over the air space above its territory.

The International Air Navigation Convention has been drawn under the commerce clause of the Constitution, insofar as it pertains to the United States. The Convention is coupled with provisions of the Treaty of Peace and the League of Nations. Even though the League of Nations or the Treaty of Peace should never be put into effect, there should be no difficulty in separating the provisions which relate to the Treaty of Peace and the League of Nations from the International Air Navigation Convention, nor any valid reason why the Convention should not be signed and ratified.

The International Commission on Air Navigation was composed of practical men, conversant with the art of aerial navigation, and rules and regulations controlling air navigation were drawn in such manner as to be acceptable to the new industry. The delegates to this Convention have dealt in a practical manner with questions affecting the ownership of the air and legal jurisdiction over air spaces.

Article I of the Convention, relating to international air navigation, provides:

> The high contracting parties recognize that every power has complete and exclusive sovereignty over the air space above its territory.
>
> For the purpose of the present convention the territory of a state shall be understood as including the national territory, both that of the mother country and of the colonies, and the territorial waters adjacent thereto.

The right of freedom of innocent passage in times of peace is granted by each of the states to the aircraft of the other contracting states, except over prohibited areas. When we consider that the question of exclusive sovereignty of each nation over the air space above its territory and territorial waters was the point of dispute in regard to which none of the contracting states could agree in 1910, and the unanimity upon this subject at the present time, we can appreciate the remarkable strides which the world is making in the drafting of air navigation regulations and laws on a uniform basis, which will insure the public safety and will prevent the chaotic condition which would arise if each

country, or political subdivision thereof, should undertake to pass air laws without regard to their uniformity.

The list of fundamental underlying principles settled by the commission in their general terms are so broad and well conceived that they give promise of safeguarding the development of the science and art of aviation. In this country we are rapidly realizing that the control of air navigation by the federal government is essential, and that this is not a matter within the province of the separate states.

In addition to the fundamental general principles, the convention defines the nationality of aircraft, and provides for international registry and the display of identification insignia. Aircraft crew and wireless certificates are required to be validated nationally, and certificates of air-worthiness and competency are also required. The necessity and desirability of standard medical requirements is recognized. Control of air navigation in this country by the federal government is not interfered with, nor will commercial aviation be hampered by the national convention, the right being given to each contracting state to "establish reservations and restrictions in favor of its national aircraft in connection with the carriage of persons and goods for hire between two points on its own territory." (Article 16.)

The establishment of international airways shall be subject to the consent of the states flown over, but non-stop flights over, or through, the territory of any contracting state will be permitted along certain designated routes, and aircraft are thereby relieved from any possibilities of detention. Provision is made for landing, departure, and when underway, every aircraft being required to be provided with certificates for registry, air-worthiness, and lists of passengers, cargo, and log-books.

The state flown over has jurisdiction in regard to every breach of its laws for the public safety, and its military and fiscal laws; and equal facilities shall be given to all in the use of air-dromes and assistance in distress.

The carriage by aircraft of arms, munitions, or explosives in international navigation is forbidden. Photographic apparatus is regulated, and there is a non-discriminatory prohibition of other objects carried where they are carried as measures of national public safety. Military aircraft is forbidden to fly over the territory of other nations.

THE U. S. AND THE INTERNATIONAL CONVENTION

I have never been able to understand why our government has not ratified the International Convention on Air Navigation. The stumbling block appeared to be that the Convention was connected with the League of Nations. I am of the opinion, however, that the words in Article 34 of the Convention relating to the institution of "A Permanent Commission" under the direction of the League of Nations do not mean that the League, as such, has any authority over the Commission, but that the Commission (which has already been established) is an independent one in fact, and that it gives notice of its meetings to the League which sends an official representative not taking part in the discussions, but merely acting as an observer. The decisions of the Commission are communicated to the League of Nations only as a matter of information. If for political or other reasons, the United States should delay becoming signatory to the International Convention on Air Navigation, the participation of the United States in the development of an aerial code and international regulations will be greatly retarded. It is my

judgment that there need be no difficulty in adherence by the United States to the Convention.

An additional factor to be taken into consideration is that inasmuch as the United States has adhered to the Permanent Court of International Justice, foreshadowed by Article 14 of the Peace Treaty, adherence may likewise be had by the United States to the International Air Navigation Convention. The result of the adherence of the United States to this Convention would have placed us far ahead in the legal development of aeronautics, in which we have been sadly outclassed by every foreign country.

If we do not enter into the International Air Code agreement, then separate treaties must be arranged with Canada and Mexico in regard to flying across boundary lines.

Flyers in Europe are thus given a wide freedom of action. Boundary lines are obliterated. Commercial companies have a definite legal standing. Consequently passenger-carrying planes are establishing air lines from country to country and city to city.

How Are Disputes to be Settled?

Before starting our world flight the State Department had to obtain permission from every country over which they intended to fly.

As the matter now stands, American aviators have no right to fly over the boundary lines of any other country. This is because we are not signatory to the International Air Code agreement. Moreover, if one of our aviators, after gaining permission to fly over a foreign country, happens accidentally to damage the person or property of a citizen of that country, we have no basis on which we may insist that he be given the benefit of the special international consideration of a flyer under the protection of the International Aeronautical Agreement.

Federal legislation is also important for the establishment of a uniform system for examing and licensing pilots and inspecting aircraft. Whatever faults the governmental administration may have, the public pins, and rightly, a great deal of faith in federal inspections.

Not many years ago the packing companies went "into the air" because it was proposed that the federal government should officially inspect meats being shipped through interstate commerce. Today both the packers and the public reap immeasurable benefits from that inspection. The same has been true of the pure food administrations, and of inspection of plants and seeds handled by the Agricultural Department. For this reason, if for no other, federal licensing and inspection of all planes that are to carry passengers will be a benefit to the Commercial Aircraft Companies.

A man's desire to fly is regulated quite largely by his sense of security. If he is once convinced that it is safe to hop off from Chicago and land in Denver, so that he can make the trip without injuring even his life insurance policy, the air lines will be popular.

If wandering and often erratic pilots are allowed to pick up old planes and start a passenger-carrying line, without any regulations or restrictions, there certainly will be accidents which will dampen the enthusiasm of the air enthusiasts.

In order that examination for a pilot's license and the safety requirements of flying planes be uniform and strictly adhered to, it has been necessary to incorporate such provisions in the "Air Commerce Act." Preferably all pilots should have the same degree of training as is required of military aviators, and for that reason it is felt

that the examination for a pilot's license should come through a board of government examiners. The manner, however, of examination, is not so important as that there should be federal authority requiring the examination and providing means for it.

One of the oldest problems in the world, and one that accompanies every new enterprise, is how to decide who is to blame in case of trouble or accident. It is the first problem of the government to lay down rules and laws by which disputes may be settled. There must be courts with authority. There must be codes for the trial, and rules by which it is determined who is at fault in cases of dispute.

Aviation being an entirely new activity in an unused and unexplored element, has found itself in America without law or precedent. As flying becomes more and more common, there will be hundreds of disputes, accidents and actions for damages between flyers and between flyers and civilians. Who is going to try them, and by what rules are they going to settle the disputes? A flyer from West Texas smashes into a deserted oil derrick in Oklahoma. The flyer sues the owner of the well for leaving the derrick standing. The owner of the well sues the flyer for damage to the derrick. Would it be tried in Oklahoma where the derrick stood? Or in Texas where the flyer lived? Would it be tried by a local justice of the peace? In the State Court or in Federal Court?

Suppose a flyer from Utah distributes literature advocating polygamy over Northern California. Could he be arrested in California and tried on the grounds of circulating objectionable printed matter, or would it be left to the courts of Utah to determine whether or not he was guilty and of what? If an aviator from Kokomo, Indiana, should be accused of stealing a propeller from another aviator in Kalamazoo and be caught with it in Denver while on his way to San Francisco with a passenger whose time was valued at a thousand dollars an hour, would Denver authorities have a right to detain him, and who would have authority to accept bail? And if he should be detained and found innocent, whom could he sue for damages in delaying his flight? And where could his action be brought? All these matters must be definitely determined, and that by federal legislation.

The reluctance of Congress to pass aeronautical bills has not been from any real opposition, but purely from a press of other matters, and because the individual Congressman has not been brought to feel the vital necessity of lending immediate and intelligent encouragement to aviation in America. There has been a remarkable unanimity in the opinion of all friends of aviation, and it has no enemies, as to the necessity of the federal government taking steps to regulate and foster this new industry. It needs to be done commercially, and it is vitally necessary to do it from a military standpoint. It is improbable that we are going to have sufficient appropriations to develop military aviation to within half of the requirements of national defense. We can hardly expect so unmilitary a people as America to appropriate much money in times of peace for fighting planes; but we can expect them as a commercial nation to foster commercial aviation to such a point that it will make factories and material available in cases of military necessity.

Those who have felt the urge of this vast new air domain of ours, which in a few years is to be dotted with flying craft, either of our own or foreign countries, have seen to it that the Air Commerce Act was passed. And now it is possible for our new infant, the

flying industry, to get a good takeoff. Our government has not been asked to subsidize aircraft; it has only been asked to adopt uniform regulatory methods, to inspect them so as to make aircraft travel safe, to use them so that our people may be given advantages which will accrue from air travel and air transportation, to improve them that we may keep abreast of air development in foreign countries and be able to take our place among the first nations of the world in time of national emergency. Aircraft are the harbingers of national peace and prosperity.

CONCLUSION

As this article, relating to what is ahead of America in the air, was in process of completion, there came this brief but significant announcement from the Department of Commerce, showing the foresightedness and serial alacrity of at least one other nation:

A trip of investigation to Reykjavik, Iceland, to study wind currents and sunbeams, and their effect upon a future airplane route between Europe and the United States, has been made by two German scientists, according to a report to the Department of Commerce from Berlin. Dr. Danmeyer and Dr. Georgi, who are professors at Hamburg, are the scientists performing the investigation.

The proposed air route would start at Hamburg, and pass by Scapa Flow, the Faroe Islands, Reykjavik, and Cape Farewell, Greenland, and would have New York as its ultimate destination. It is planned to send a large scientific expedition to Iceland next year to investigate in detail all conditions which would likely affect the operation of airplanes over the comtemplated route.

Persons in Germany interested in the project say that under favorable circumstances the projected line may be opened by the beginning of 1928.

This, in a paragraph or two, is apparently the comeback of Germany, until recently the "lame duck" of the air, following the World War. Germany's horizon, as to commercial aviation, apparently is world-wide. Already, from her crippled condition, she is far ahead of the United States in operation of mail, freight, and passenger-carrying airlines, just as she was twenty years ahead in the development of an air code. Other foreign nations are almost abreast, or coming in on the aerial stretch.

The Passage of the Air Commerce Act last year by our Congress—and may American capital and transportation genius utilize—was not too soon.

Are We Airworthy?

By Lieutenant Donald Duke
Chief, Airways Section, Air Corps, United States Army

TALK with today's busy men and women about flying, and ironically they approve it—for others, yet most of these same people, before many years have passed, will have acquiesced to the safety of properly regulated flight. With demands on their time and presence, assuming proportions impossible of fulfillment by railway or motor, utilization of the wings of progress will follow as a natural concomitant, and the horizon of man's achievement will again be enlarged. And why are we afraid to fly?

The Fearful Public

Fear is habitual with most people, although not many acknowledge it their master. Like fashions and madam's tresses, our fears come and go; childhood ghosts give place to countless other fears equally fallacious. When science proves our pet apprehension to be without foundation, a new model, more enticing and with still more mystery under the hood, compels us to convert our insurance to an eight-cylinder policy, and so the human race advances with fear ever stalking at its heels. Columbus in crossing the ocean proved groundless the fears of his companions, and with the subsequent advent of prohibition made the Atlantic a "best seller." Now over one million persons cross it annually, apparently reconciled to any fear of collision or sinking. Travel by rail at a high rate of speed, guided only by two ribbons of steel, over lofty narrow bridges, around curves and through tunnels, no longer holds terror for a public ever willing but always fearful in adjusting itself to new standards. But what of going aloft?

The drone of airplane motors, or more properly, the hum of their propellers, is becoming a daily event along our well-traveled air routes, arousing little or no interest from those below. What goes on above, within these fast-moving objects, is likewise becoming commonplace to an ever-increasing number of people using this means of transportation for business or pleasure. However, the factors contributing to the scheduled arrival of these winged sedans at distant airports, is a story now emerging from the romantic atmosphere of superhuman achievement to become the plain, unadorned, routine performance of normal human beings.

False Publicity

Air transportation, in spite of unfavorable and unfair publicity, has taken its inevitable place as an integral link in the world's transportation system, and should no longer be judged by the spectacular antics of stunt flyers. Public confidence in air travel has been retarded through the nefarious practice of winged imbeciles, whose exploits, contributing nothing to aviation's progress, have only proved that the best planes made can be torn apart or disabled by forced abuse.

There is no activity in existence that could possibly profit more from a "truth in advertising campaign" than aeronautics, all too frequently the front-page victim of publicity strategists, whose insatiable desire for sensational news forces on a gullible public its daily dozen thrillers. Publicity has long been the accelerator of progress, but as a propagator of aviation it has

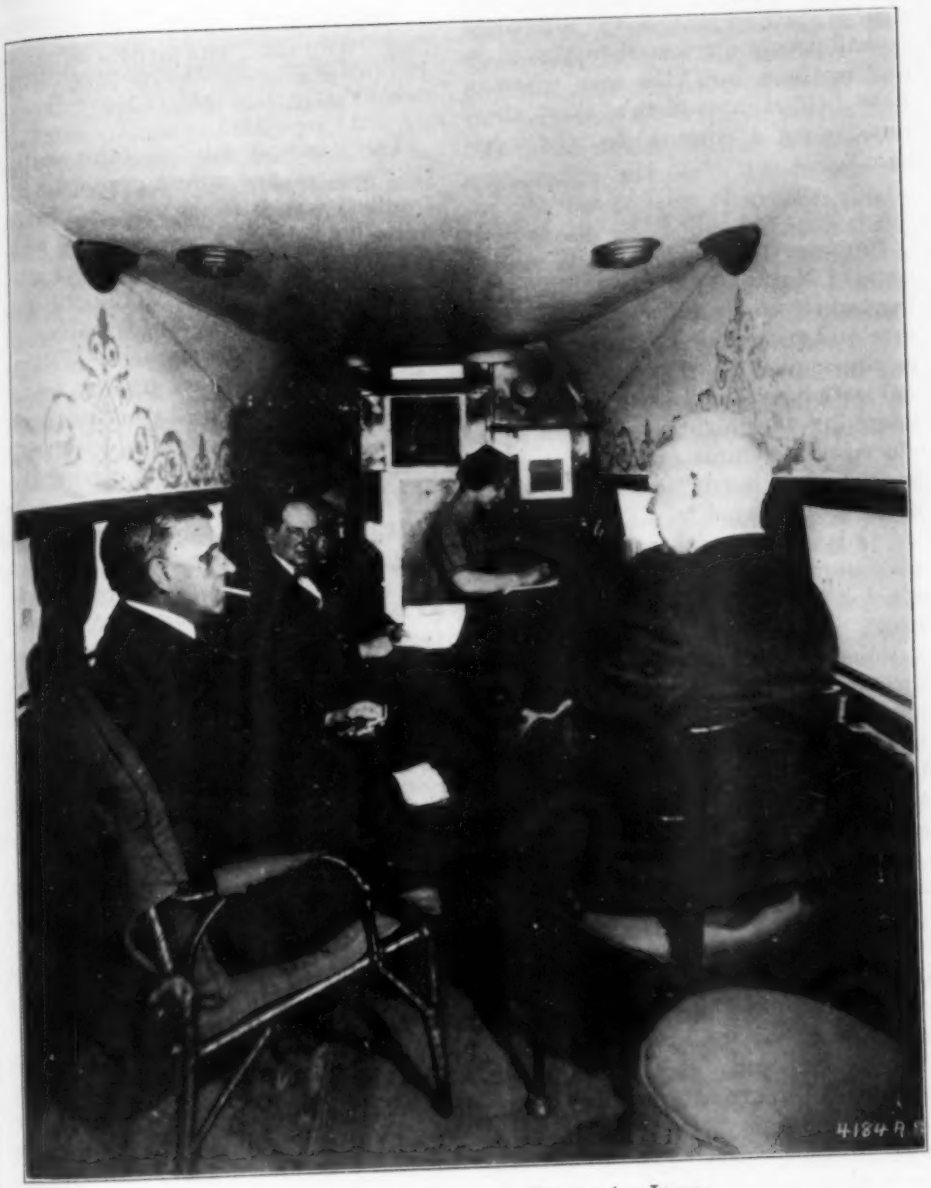
left the public confused, misinformed, and afraid to "go up." Nor any wonder when one reads news items, almost daily, of sensational and fictitious events in the air, while the sinking of a ship or a railway wreck is of little interest, except for the victims listed. The much abused "air pocket," "stalling plane," "tail spin," "flying coffins," and such other stock phrases in common usage, may have their place in "movie thrillers," but not in commercial aviation of the present time, operating airlines with a day and night flying schedule equal to railway dependability, and in some cases exceeding the year-round performance of our best trains.

DANGERS ELIMINATED

There is no danger in air navigation which cannot be eliminated by adequate precaution; and man, woman or child has no more to fear when taking passage in the well-equipped air transports of today than in vehicles common to the other established systems. All are alike, insofar as skilled personnel, properly maintained operating equipment, and safety precautions are concerned. The train, the boat, and the motor coach have supporting elements no more substantial than the aircraft. It is only that the age has not yet become accustomed to the air, as a supporting medium, that more people do not utilize its advantages. We do not have to look back many years to see our own parents afraid of ocean liners and rubber-tired contraptions, without which present-day social, civic, and industrial standards would be impossible. It is, therefore, only natural that air as a medium for transportation should be put to practical and profitable use at this time, since it is just as essential to the continued progress of mankind as each successive method of transportation has been in the past.

For centuries, primitive man transported commodities on his back, until reason and experience placed this burden in turn on the beast, boat, stagecoach and railway. Today finds the United States leading the world in railway mileage, with a standard of service likewise unequaled, yet the man in New York, whose presence is required on the West Coast or in a southern state, is already growing impatient at the loss of time required to transact his business and return. One of our large automotive corporations is already putting to practical use a luxuriously appointed ten-passenger plane for transportation of its officials, between general offices and factory one hundred and thirty-five miles distant. Business emergencies, necessitating hasty conferences of scattered executives, are thus satisfactorily met, and action expedited in a manner impossible with surface transportation facilities. Using a multi-motored plane of proven airworthiness, flown by a pilot of proven ability, between well-equipped airports, with known intermediate landing fields and beacon lights at intervals along the route, these officials not only travel safely and comfortably at a great saving of time, but with impunity invite their guests to accompany them, regardless of the fact that twenty-five per cent of their flights terminate after dark. The number of privately-owned planes used for commuting from the country home or for sport flying is increasing each year, and only the present lack of adequate, close-in airport facilities makes this practice less appealing to the business man, since the cost of planes suitable for this purpose is about the same as the car he now uses.

And again the query—why are we afraid to fly? Is it because lacking feathers we hesitate to encroach upon the bird's domain? Then where are



INTERIOR VIEW OF PRIVATELY OWNED AIR LINER

the scales and other habiliments to make our ocean voyage consistent? The hesitancy of severing contact with mother earth to soar aloft is sometimes ignominiously attributed to the wives and mothers, but "the man who can hide behind a woman's skirt these days is not a coward—he is a magician."

FLYING SAFE

Contrary to public opinion, and in spite of Newton's laws of motion, flying, when conducted with the same care and regard for safety precautions as are applied to railways and ocean navigation, is equally safe and equally deserving of public confidence. Engineering standards are more exacting in aircraft construction than in any other public vehicle. The factor of safety is far greater than needed for the maximum load to be carried. The much-heralded flaming plane—a rare event even during the war when gasoline tanks were the target for incendiary bullets—is a present-day anomaly, since the danger of fire in the air is no greater than fire in a boat, train, or automobile, and in either case there are the usual fire preventatives and a suitable method of escape.

After ten years of travel by air, rail, automobile, and on the hoof, I am convinced that getting about below makes one think faster and jump quicker than in the great open spaces aloft where railway crossings, street intersections and stop-go signals become memories of earthly vesture. If given my choice of vehicles for a trip to the West Coast, or any distant city with a good airport, I would unhesitatingly choose the plane for both myself and family. It would get us there quicker, without the monotony of railway travel and the discomforts of water travel. John Logan, poet of the eighteenth century, has beautifully expressed, in the following lines, his vision of what should now be a common occurrence:

> Oh, could I fly, I'd fly with thee!
> We'd make with joyful wing
> Our annual visit o'er the globe,
> Companions of the spring.

The common misconception exists, that because one cannot gaze upon the troubled waters from Niagara's brink, or walk on the edge of a precipice without dizziness, one would not be a good airman, which is not at all the case but, on the contrary, proves that individual to be normal in this respect. Walking on the edge of a high railway bridge produces dizziness that does not occur on the same bridge in a passenger coach. It is all a matter of perspective, which in the airliner is made more glorious by the enlarged horizon. I have taken up children, as well as men and women in advanced years, and have yet to see a healthy normal person, who, having flown under favorable conditions in an airworthy plane, did not express a desire to repeat the performance.

Flying is the most wholesome recreation I know of, inducing an exhilerating relaxation, and at the same time providing the opportunity for retrospection and introspection that one seldom feels midst terrestrial surroundings.

PILOTS

While monotonous to an extent for the pilot, particularly at night, there are many aviators in the military, air mail, or commercial service who, in the ten or more years of flying, have spent a large portion of their time in the air and still find it too fascinating to give up. Contrary to another misconception, these pilots, like wine and a certain type of automobile engine, improve with the passing years. The seasoned airman is better equal to the added responsiblilities of aviation's

progress than is the younger flyer with less time in the air. The average person of either sex can learn to fly if given sufficient instruction, but only a small percentage become expert. The annual report of Major General Mason M. Patrick, Chief of Air Corps, U. S. A., has the following pertinent remarks in this connection: "It becomes more and more apparent that some men can learn to fly and others cannot, just as some have musical or mathematical ability and others do not. The attempt to teach one who lacks it is a waste of time, money and effort." While fifty-six per cent of the applicants for flying training at military schools pass the required physical standards less than thirty per cent of those accepted receive the coveted rating. It is in these schools that a majority of the pilots now flying commercial aircraft have received their training. The employment of pilots for aircraft operation, therefore, is one case that admits of no compromise,—skill and experience being indispensable prerequisites to safe and conservative flying.

SAFEGUARDS

Providing the proper safeguards for interstate air navigation has presented many new and interesting problems to the engineering and legal professions. The aircraft en route from New York to Chicago, with its passengers, mail, and express, differs from the railway train bound for the same place, only in speed and the supporting element. The station becomes the airport; the train dispatcher the operations officer; the way station agent corresponds to the emergency landing field attendant; the roundhouse becomes the hangar; and the block signal system of the railway is analogous to the ground panel signalling system, just coming into use on some of our airways. Having no rails to guide it, the aircraft traverses an airway, which word, being too new for the dictionary, may be generally defined as an established, identified route, traversed by aircraft and with facilities provided for convenient, safe and economic air traffic. Like a ship at sea, the modern airliner is equipped with radio, not only to report its progress but to learn of weather conditions ahead, which may require a slight change in the course to be navigated, or if threatening, a temporary landing at the nearest airport. The compass and other special instruments indispensable to safe navigation enable the pilot to proceed even though the landscape below may be obscured by clouds or darkness. Beacon lights, both revolving and fixed, identify the path between airports at night, and upon approaching a destination or other required stop, the landing area is distinctly outlined by vari-colored weather-proof electric bulbs. Upon proper signal this airliner glides down from the darkness, to land gently on an airdrome made light as day by a 500,000,000 candle power diffusion light. Passengers and their baggage, again on *terra firma*, are whisked away in waiting motor coaches to hotel, railway, or ocean liner, if necessary, to continue their journeys by these means. The plane in the meantime is taxied into its hangar where skilled mechanics, with tender solicitude, treat it as a thing possessing life. The consideration given to their planes by two of the round-the-world flyers amounted almost to devotion, and was admittedly responsible for these pilots' noticeable lack of trouble due to mechanical malfunctions.

Passengers flying along a well-equipped airway in such an airliner, with conveniences installed comparable to railway travel, have less to fear from collison or accident than when behind a

Soon shall thy arm, unconquer'd steam! afar
Drag the slow barge, or drive the rapid car;
Or on wide-waving wings expanded bear
The flying chariot through the field of air.

—"*The Botanic Garden*," *Erasmus Darwin, 1731–1802.*

speeding locomotive, or the driver of a skidding taxicab. Aircraft, equipped with navigation lights conforming to the standard employed on the high seas, are readily discernible in darkness. Both pilot and assistant pilot are on the alert for approaching or overtaking craft. Here again, rules of the air are in force and, due to the almost unlimited choice in altitude and deviation along a horizontal flight path, the possibility of even sighting another plane is very remote, though its schedule and approximate location are known.

With specially prepared maps and facilities for dissemination of meteorological data needed for aerial navigation now being perfected through government aid, and with proven dependability of new aircraft engines, the forced landings of by-gone days have been practically eliminated from well-managed commercial air transportation. However, should it become necessary to make an unscheduled landing, along an airway at frequent intervals are intermediate landing fields marked to make their location easy, and equipped with proper facilities for night landings. Wheel brakes, now used on airliners, have reduced the required landing area to about one-half the distance formerly needed. Other improvements have placed the modern airliner far beyond its wartime progenitor, of which the less said the better.

The failure of attempted freakish aircraft performances, wherein both engineering standards and common sense are sacrificed by so-called "crack pilots" for self-glorification, have no more bearing on aviation's true mission than has one of Will Rogers' non-stop diplomatic flights on our national jurisprudence.

Equally significant and indicative of the hazards peculiar to different requirements in aviation, is the record of one commercial aircraft operator whose planes have flown 4,500,000 miles without a passenger fatality (equivalent to 173 times around the earth), while fatalities in the military services (U. S.) have averaged one per 273,510 miles of flight. The exacting requirements of the latter, in testing experimental devices and new equipment, instruction and formation flights in military tactics, and securing performance data on heavily laden planes, create conditions that do not occur in commercial flying conducted to schedule day after day, along the same routes, with standardized planes of proven performance, and with reserve planes held in readiness at either terminal for replacement of equipment needing minor adjustment. Pilots of commercial aircraft also enjoy a greater freedom from responsibility and fly with greater regularity—two factors essential to keen-edged proficiency in handling aircraft.

PROGRESS IN THE UNITED STATES

We read much of the subsidized commercial airlines of Europe, and statisticians have a penchant for quoting figures on the number of passengers carried by foreign airlines, but little is said of the commercial aviation in the United States, which, without subsidy, is establishing itself on a firm economic basis.

The development of air transportation, since the close of the World War, has made substantial progress, surpassing relatively the early development of water, rail, or automotive traffic. Following in the wake of overenthusiasm and imaginative prophecy depicting inconceivable accomplishments, aviation, both military and commercial, has responded to a degree almost incredible. Sir Samuel Hoare, British Secretary of State for Aeronautics, has recently said, "Aviation has a habit of providing great surprises and I, personally, am prepared for anything."

With the Department of Commerce establishing, charting, and safeguarding civil airways, restricting air commerce to airworthy planes, and requiring operating personnel to hold airman's certificates, our capricious fears of flying will disappear and public confidence, elevated above the horizon of its own misgiving, will proclaim air commerce, and demand that the airplane's birthplace shall no longer repudiate its utility.

Are aviators afraid? Fear is not a substantial thing that can be photographed or placed on exhibition but rather is known by its fruits. Aviators, as a class, according to an army dentist, are "the biggest cowards applying for treatment," yet these same individuals in the cockpit of an airplane, or the control car of an airship, display with exuberant mastery a skill and courage that finds no parallel in legendary or present-day exploits. Afraid? On the ground, yes; in the air, no. The lieutenant frightened speechless by a general's rebuff has no fear of leaping into space with his parachute should this become necessary. What the psychiatrist calls a complex is the airman's *ce n'est rien*. Magnanimous through environment he is not the pretender judged by earth-bound critics after their own standard, but copes ever astutely for the mastery of self, that self-control which in every phase of human activity characterizes true achievement with progress its recompense.

Air commerce in the United States, already a reality, is rapidly spreading its network of airways to better serve its homogeneous millions, 34.3 per cent of whom dwell in ninety cities of over 100,000 population. The airlines of Europe, far advanced by comparison, are likewise extending their facilities to Egypt, India, South Africa and distant Australia. In all countries of the world, air transportation is an accepted requisite, both for economic development and national defense. Facilities, skill, and experience, necessary for the establishment of a trans-Atlantic air route, are available in the United States today. This link, indispensable to world air commerce, is inevitable, and more than 1,000,000 people who now cross the Atlantic annually are awaiting a better and faster method of transportation.

With planes overhead in constantly increasing numbers, have we not already seen the realization of Tennyson's prophetic vision in "Locksley Hall":

I dipt into the future, far as human eye could see,
Saw the vision of the world; and all the wonder that would be;
Saw the heavens fill with commerce, argosies of magic sails,
Pilots of the purple twilight, dropping down with costly bails; . . .

Some Economic Aspects of Aircraft Transportation

By Stephen B. Sweeney
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It is usually exceedingly difficult to intelligently consider any particular phase of a very broad subject without first getting a general picture of that subject. This is especially true of so recent a development as aircraft transportation.

But an accurate general picture of aircraft development is difficult to obtain in these days of rapid progress. In addition to the difficulties caused by constant change, we have those resulting from the inaccuracies of newspaper and quasi-scientific journal reports, as well as the confusion caused by statements of extremely optimistic promoters and generally interested individuals. The only safe course is to confine oneself to the limited, statistically supported information, and the conservative statements of some few trustworthy authorities.

The Present Development

The term "aircraft transportation" includes, in its broadest sense, lighter-than-air (dirigibles, etc.), as well as heavier-than-air (airplanes) craft. But in most of the current discussion of the subject the term is practically confined to transportation by airplanes. There are some few instances of successful commercial dirigible operation, in Germany in particular, but they were largely sporadic post-war gestures. Any mention made of them must be merely to indicate possibilities in other than the present most exploited field.

Regular aircraft transportation has already made many formerly distant cities "overnight neighbors" of each other, at least as far as mail and passenger communication is concerned. An examination of air maps will show a surprisingly heavy network of regular air lines spread over Europe, fair beginnings of such a network in the United States, Australia, and parts of Asia and Africa, and a brave start in South America.

A World "Air-Picture"

An interesting picture, but a difficult one to draw because of the paucity of statistics available, would be a series of yearly maps, of Europe particularly, since the close of the World War. Attempts at regular aircraft transportation had been made prior to 1918, but they were either distinctly experimental or military. Former Professor E. P. Warner, now Assistant Secretary of the Navy in charge of Aeronautics, made the following generalization in 1922, after a European air tour: "The routes will be observed to fall into four general classes, those radiating from London, the lines of Southern France and the Iberian peninsula, those of Germany and Northeastern Europe, and the French lines running to the east and northeast from Paris." A superficial examination of the development to 1927 does not seem to bear this out. The network seems to be a more or less general maze. But yearly maps would show that additions since 1922 could practically all be placed in some one of the four general classes outlined by Professor Warner. France, England, and Germany are still the outstanding centers of development. This is partly because of the presence of some of the economic fac-

tors discussed below. But the main explanation for the intensity of development of these centers is a political one. France has spent millions of dollars in subsidy each year despite a long unbalanced budget. England and Germany have not been far behind.

The more important recent developments are those pushing the means of rapid communication into the East. Moscow, Rostov, Batum, Constantinople, and Angora may now be reached in relatively few hours by air from Paris, Berlin, and London. There are nine daily services from London. An air trip from Cairo to Bagdad seems confronted with many difficulties, but its accomplishment is now regularly possible.

The Mediterranean is rapidly being "bridged" at many points of its western end. Casablanca, Oran, Algiers, Biskra and Tunis are now one-day excursion points from Europe and look like starting points to try out the possibilities of air transportation in Africa. (*See* map page 176.)

The air transportation map of the United States is not so similar to a close network. Vast distances are practically wiped out here, however, as far as mail is concerned. New York and San Francisco are now approximately thirty hours apart instead of five days as formerly. "Wing tracks" may now be found wending their way directly (or indirectly via the transcontinental air mail route), toward Chicago from many such outlying points as Seattle and Pasco (Washington), Los Angeles, Pueblo, Dallas, New Orleans, Miami, Boston, Detroit, and Minneapolis. (*See* map page 171.)

South America made its start, thanks to enterprising, efficient Germans. "Efficient" because the regular service maintained between Cartagena and Bogota is said to be the only self-supporting common carrier air transportation company in the world at the present time.

Our world picture is not complete until we note that Australia is well on the way toward completing an air circuit between its most important cities. Inland points, as well as seaports, are connected, and it is not hard to imagine Perth and Adelaide, Sydney and Charleville, and Camooweal and Derby joined by air in the near future to complete the circle.

Statistics of Air Transportation Development

During the years 1920–24 over twenty-five million miles were flown throughout the world over regularly operated air routes, and it is estimated that this aggregate was increased to thirty-four million miles by January 1, 1926.

Some idea of the rapid increase in mileage flown during these developmental years may be gained from comparing the 1920 mileage figure of one and three-quarter million, with the 1924 figure of eight and one-half million.

Some other increases of interest are:

1. The number of miles of regularly operated air routes from 6,794 to 19,148, or an increase of 181 per cent.
2. The number of completed trips over regularly operated routes from 5,920 to 36,445, or an increase of 515 per cent.
3. The number of passengers carried one stage or more from 9,233 to 66,262, or an increase of 617 per cent.
4. The pounds of express carried one stage or more from 482,230 to 3,813,586, or an increase of 690 per cent.
5. The pounds of mail carried one stage or more increased from 566,744 to 2,839,836, or an increase of 401 per cent.

Europe naturally commands first consideration in any examination of commercial air transportation. This is a disputed point if technical progress is the accepted criterion; but it is indisputable if mileage flown and operating experience built up is to be the test. The latter seems the more practical measure.

Of the twenty-five million miles flown throughout the world from 1920 to 1924, Europe was responsible for seventeen and one-half million, or 69 per cent. The United States came second, with six and three-quarter million, or 26.6 per cent, and then Colombia and Australia combined, with a little over one million, or 4.4 per cent. Miscellaneous statistics covering the period to date indicate that the above order is still indicative of relative activity.

As will be seen from the following statistics, Europe's development has been general throughout the range of the points of transportation interest. During the period 1920 to 1924 inclusive the following increases are worthy of note:

1. Number of miles flown, 380 per cent.
2. Pounds of mail carried, 3,080 per cent.
3. Pounds of express carried, 650 per cent.
4. Number of passengers carried also increased 590 per cent.

It will be recalled that France, England, and Germany were mentioned as the focal points of European commercial aviation. The following figures substantiate the map impression. Regular French lines were responsible for eight million miles, or 31.9 per cent of the total four-year world mileage. This was 5.4 per cent more than the United States with its world-acclaimed air mail (before the beginning of its present seventeen feeder contract routes). English planes flew three and one-half million miles, or 13.9 per cent of the total. German planes flew a little over three million miles, or 12.6 per cent of the total.

Development and Subsidy

These three countries have another point in common along with all other European countries. From an economic standpoint all of their lines are parasites. "The total subsidies of England, France and Holland for 1924, at the current rate of exchange amounted to approximately three million dollars."[1] In 1926 the French government voted the largest subsidy to date.

This aid, that makes their continuously unprofitable operation possible, takes the form of direct and indirect subsidy. The direct can be generally summarized as follows:

1. Generous loans over period of years at no interest (England and Holland).
2. Payment for specified air mail routes (Germany).
3. Annual money grants based on distance flown, etc. (France).

The indirect subsidies can be so extensive and complete that their costs do not lag far behind the direct. They take any or all of the following forms:

1. Creation of airports (where government hangars and other facilities are rented at a nominal sum).
2. Dissemination of meteorological knowledge.
3. Free use of radio communication facilities.
4. Development of technical appliances.

[1] Department of Commerce and American Engineering Council Joint Report on *Civil Aviation*. McGraw-Hill, 1926. This is a very complete and scientific report and is the source of a good many of the figures above.

5. Loan of improved types of transport planes.
6. Passage of laws limiting the liability of air transportation companies.

These subsidies are justified on various grounds. The so-called "infant industry" argument is often heard in disguised forms. Usually the various governments consider commercial aircraft development an important factor in defense. A glance at the map of Europe, in light of the last war, explains this. Some attribute the progress and willing lavish expenditure to the education resulting from regular lines throughout the continent. The French give the following justifications for their expenditures:[2] Air lines

1. Serve as a political connection with Roumania and other Balkan states.
2. Interest the Balkan countries in French aeronautical products.
3. Act as a laboratory for service, testing new types of planes, engines and equipment.
4. Facilitate the study of long distance aerial transportation where present communications are in general disorganized.
5. Counteract the influence of English and Dutch lines flying into Paris.
6. Connect France with its colonies in North Africa.

These are typical of the reasons advanced throughout Europe for the maintenance of transportation agencies whose operating revenues range from 6 per cent to 40 per cent of operating expenses. And the trend seems to be toward increasing subsidy with a consequent steady expansion in commercial air activities.[3]

The development in the United States can hardly be attributed to paternalism alone. The routes in this country have had to rest more or less on their own merits from the economic standpoint. The purely commercial projects in this country have never received any direct governmental aid. What little indirect aid they have received, such as the activities of the Army Airways, has been negligible. Even the government operated air mail has abolished services ardently promoted at first, but eventually admitted unsound from the dollars and cents standpoint. Any statistics of the United States development up through 1925 usually refer solely to the activities of the Air Mail service, because private activities were largely sporadic and were not scientifically reported. This explains why United States statistics of passengers and freight carried are lacking. There were no *regular* services of these types. With the passage of the Kelly Bill, February 2, 1925, authorizing the private operation of air mail service under contract, along with passenger and freight service, this situation was changed from 1926 on.

It will be recalled that the United States planes flew 26.6 per cent of the world mileage, 1920–24 inclusive. During this period the increase in yearly mileage was from 549,244 to 1,522,763 miles and to 2,076,764 miles during 1924, or a grand increase of 275 per cent. The pounds of mail carried increased from 526,578 to 1,500,034 or 288 per cent.

[2] Van Zandt, J. P., *Report on the Commercial Air Transportation Activities in England, France, Germany and Holland*, June, 1924, p. 39.

[3] Van Zandt, J. P., *European Commercial Aeronautics*, May, 1925, p. 3. These are two very worthwhile reports prepared for the National Advisory Committee for Aeronautics from first hand information gathered by Lieutenant Van Zandt on trips over practically every European air-way.

The Colombian and Australian progress is just as marked. The former is of special interest because it is supposed to be self-maintaining. It enjoyed the following increases from 1920–23 inclusive:

1. Miles of regularly operated air routes from 794 to 1,069 or an increase of 34 per cent.
2. Number of completed trips from 208 to 531, or an increase of 155 per cent.
3. Miles flown, from 2,687 to 180,833, or an increase of 6,629 per cent.
4. Passengers carried, from 12 to 1,084, or an increase of 8,933 per cent.
5. Pounds of mail, from 110 to 23,576, or an increase of 21,360 per cent.

The Australian development is highly subsidized on the basis of knitting together a country of inaccessible centers of population. Its progress is most unusual in view of the short period of operation beginning in 1922. The increases during the first three years are as follows:

1. Miles of regularly operated air routes, from 1,772 to 2,809, or an increase of 58 per cent.
2. Number of completed trips, from 1,045 to 1,853, or an increase of 77 per cent.
3. Miles flown, from 153,521 to 253,072, or an increase of 64 per cent.
4. Passengers carried, from 681 to 1,472, or an increase of 116 per cent.
5. Pounds of express carried, from 6,398 to 11,345, or an increase of 77 per cent.
6. Pounds of mail carried, from 5,468 to 10,406, or an increase of 90 per cent.

All of the figures in the preceding pages cannot help but impress an examiner with one outstanding fact—increase. Whether or not this increase means progress is largely dependent on the individual viewpoint. If that viewpoint is predominantly political and nationalistic, progress can be seen at every turn. If that viewpoint is economic, further data will have to be considered.

SOME DISTINCTLY ECONOMIC FEATURES

The task of examining the distinctly economic features of aircraft transportation is no easy one. Any discussion of them is usually so linked up with political and social considerations that their absolute segregation is well nigh impossible. There are many border-line cases. But for the sake of clarity of thought some such separate discussion must be attempted.

From the economic standpoint the broad general task of commercial aircraft transportation is to add more value to the material moved than the extra cost of the service. This word "material" must be taken in its broadest sense to include mail, freight and passengers. The general question of costs illustrates one of the border-line cases.

For the purposes of this discussion costs will only include those direct costs of the transportation agency. There are bound to be social costs such as government research work, navigation law maintenance, etc. The extent of these costs is almost impossible to compute and spread over the various operations.

There are some general features of this problem of adding an increased net value. The country to be served is an important consideration. In promoting a transportation agency whose outstanding selling point is speed, a

high standard of living in the country to be served is essential. Under ordinary conditions speed means little to the nomad, the Chinese coolie, or the mountain trapper. Speed means much, however, where the division of labor is great and people are highly specialized with the resulting complex system of exchange. Economic progress seems to be very definitely tied up with the interdependence of society; and the more interdependent society becomes, the greater will be the premium placed on speed.

Attempts have been made to establish aircraft lines in localities of minor industrial importance. Where the chief occupations are cattle-raising and agriculture, and the market for goods of high intrinsic value is very restricted, these attempts are bound to fail unless they are artificially supported. One authority summarizes this situation as follows: "The airplane has proved of value in sparsely settled regions where surface transportation is difficult or impossible; but traffic in such instances is, and for a long time must be, light. Its chief use will be between large and active centers of population, sufficiently far apart or otherwise so located as to permit material saving of time."

A number of services have been thriving apparently, on more or less unusual situations. One of these is the fact that it is quite the fad in some centers of the world to include a trip by air in any "well regulated tour." The permanence of this asset is difficult to estimate. While it is true that a great many communities and industries depend on luxurious expenditure, it is hardly a safe basis for a transportation system. The capital investment is too great.

Another asset of questionable importance has been the facilitated customs service at air ports. This has been responsible for a good deal of trade, but it is hardly a feature on which to build for the future or on which to base any great investment of fixed capital. If aircraft transportation enjoys the growth predicted for it by its ardent advocates this advantage will soon disappear. Customs clearance will be as involved and as slow as at the centers of other means of transportation.

The Wisdom of Subsidy

When one considers the development of European air transportation, the question of the economic wisdom of subsidy is forced to the forefront. The feeling among experts is that commercial aviation in various countries has suffered in direct proportion to the extent that artificial aid has been received. The feeling is that the conditions surrounding subsidies are not conducive to normal economic growth. Very often they are interfering with normal development. If this is not the case the opposite may be true, *i.e.*, they may be granted too freely, and therefore be employed in a manner opposed to the good of the industry. Lieutenant Van Zandt makes the following summary which would probably be acceptable to most of the authorities in the field: "In general, a policy of direct subsidy grants has not resulted in placing air transportation on a rational business basis. . . . In several instances large contracts for regular consignments of goods have had to be refused by European air lines, because subsidy relations and other handicaps have made it impractical to handle them."

It is generally felt that certain indirect subsidies are absolutely essential. These are hardly considered subsidies in a good many instances because the providing of them is looked on as an ordinary exercise of the police power. Government maintained ocean naviga-

tion facilities are taken for granted. It is felt that the provision of essential air navigation facilities is a direct responsibility of the government. The average fixed base operator is not able to provide them. If he could provide them, it would be difficult, if not impossible, for him to prevent competitors from making use of them free of charge, except as regards the use of his terminal fields. Even though the latter could be monopolized, one public official recently voiced the opinion of many when he said: "The time is not far off when a municipal airport will be an essential part of each city's publicly maintained equipment."

While not directly economic, the development of public opinion will have a direct bearing on the success of any enterprise. Airship lines have been projected and all but started, only to be ruined at their inception by most untimely disasters arousing adverse public opinion. It will be recalled that gradual education and favorable public opinion have been given as one of the important reasons for the advanced European development.

Closely connected with this problem is the one of educating the public to avoid unwise investment in aircraft ventures. A few such unfortunate experiences serve to stamp on the public mind an impression that is hard to erase and the evil effects of which are long felt.

There are many points that should be carefully considered by the general public before investing their money in what must remain, for some time to come, a highly speculative enterprise. The method of financing, the proposed routes, the type of equipment (particularly the type of plane in light of the service to be maintained), rates of depreciation allowed, the operating personnel and the character sources and probable volume of traffic are some of them.

As part of this same thought it should be remembered that purely speculative ventures have proved unprofitable. Unusual trips have been undertaken with a view to the advertising benefits resulting. One of the most successful lines in Europe attributes a good part of this success to the fact that it has steadfastly refused to engage in such tempting projects.

Further mention will also be made of the fact that in few instances do we find what might be called economic or cost of production rates prevailing. This applies to mail as well as passengers. We have instances of sharp decline in mail offered when rates were put on an economic basis. This fact introduces a new caution for the investor. One must be wary of accepting present charges for aircraft transportation as indicative of the competitive power of the service with already established means of transportation. This caution is especially necessary when the rates for European air-lines are quoted.

Traffic is Paramount Interest

Probably the most important lesson that each operator has had, and will have, to learn is that traffic must be made the paramount interest. It is at this point that another limitation is placed on progress by subsidized development. Aircraft operators are just like other human beings. They cannot serve two masters well, and if they are looking toward sound development they will concentrate on providing regular dependable traffic service.

If the operators produce a favorable combination of speed, safety, reliability, cost, and availability, it is hardly over-optimistic to predict a sufficient volume of traffic to support operations in the economically advanced portions of the world. Attempts are made at various times to estimate available traffic for proposed transportation enterprises.

Any methods used must be expected to have a high degree of probable error. If this were not so one of the most speculative elements would be absent and the prize of large possible profits could hardly be expected. One such method offered is as follows:[4]

Estimate a. Degree of municipal interest
b. Postal receipts
c. Special Delivery Stamps
d. Postal delivery area
e. General managing, merchandise, etc.
f. Average amount of daily mail and of first class mail destined for places beyond overnight train service

It was found that this last item bore a singularly stable ratio to the total mail at each point, and varied from 1¾ to 2 per cent. This ratio was practically the same in all the cities studied. The traffic estimated from the above data was discounted 60 per cent in making the final estimate of initial traffic.

In common with all other traffic enterprises aircraft operators have found a great problem in balancing their traffic. Usually one direction is more favored than the opposite. A particular phase of this same common problem, that they probably suffer from most acutely, is the problem of intermediate stops. If a space is filled from a starting point to an intermediate point it is often impossible to sell this space from the latter point to the final destination. Then again if the space is completely sold out at the first point to final destination the intermediate point cannot take care of local patrons. These problems are particularly acute in aircraft transportation because of the limited amount of space in the airplanes at present available for commercial operations. It is interesting to note that the Germans propose detachable "gliders" to take care of this problem.

[4] Department of Commerce and A. E. C. Joint Report *Civil Aviation*, p. 77.

Territory of Operations

In most land transportation enterprises topography is of great moment. Mountains and water are often barriers to railroad extension, and are always costly obstacles to overcome, which costs must be met by the consumer. This is not so generally true in aircraft transportation. As a matter of fact such obstacles are usually assets, as the cost of flying over them does not usually differ materially from other flying. This gives the aircraft operators a competitive advantage which helps bear the relatively higher cost over areas of easier land navigation.

This is not true of weather conditions. These are of little moment with railroads and steamships, but may very materially hinder the economic position of aircraft carriers in certain localities. Catering to traffic interests has been mentioned as of paramount importance. Regularity of service is generally conceded to be one of the outstanding requirements of paying traffic. This regularity means uninterrupted service, as well as service rendered in the time contracted for. In certain localities winter flying has been found impractical if not impossible. In others it is sporadic. Scheduled time maintenance has often had to be sacrificed because of weather conditions. This irregularity is more important on short lines because of the relatively small amount of time saved. These factors should be remembered in determining the soundness of aircraft investment in a given locality.

Many things are said to be *the* problems of successful aircraft transportation. One of these is certainly safety. This is largely dependent on proper organization and maintenance, as is shown by the lower insurance rates enjoyed by well established European air companies over land and water

carriers. But the problem still has many unsolved phases. Not the least of these are those of correct altitude estimation, particularly for landing in bad weather, and of two way communication, *i.e.*, from land to plane and plane to land.

Speed has been mentioned as an outstanding traffic factor. This is not strictly accurate. Saving of time rather than speed is the controlling factor. Another examination of the various air maps will show that air lines have not yet entered those areas where short distances are easily and quickly negotiated by a well organized railroad system. The possible time saved is usually relatively negligible in these instances even though great speed is attainable.

Says one authority: "From 300 to 600 miles is the worst possible distance for an overland air route, since that is the distance over which travel by night presents the greatest advantages. It is economically unsound at the present time to attempt to run air lines over routes already well served by railroads if the distance between the termini of the line is such as to make an easy night's journey by through train."

We find the most prosperous companies operating routes requiring more than a night's run by rail, broken journeys to change from rail to boat and back to rail, and those requiring wide detours of surface transportation to avoid bodies of water, etc. These routes offer excellent opportunities for great saving of time over existing transportation facilities.

The location of the airport is very closely connected with the problem of saving time. Instances are given where motoring to and from airdromes consumes as much time as is saved by the extra speed of the airplane over the railroad. This condition would hardly justify the extra rates and hazards involved in the rise of former carriers. Accessible municipal airports are urged as the solution of this problem.

Operating Costs

The idea of cost reduction is a very vital side of this problem of increasing the net utility of objects transported by air. This problem has many aspects some of which have been already referred to indirectly. It seems that the operation of short routes alone is not economical. Aircraft transportation, along with other industrial enterprises enjoying relatively increased returns from large scale operations, seems to be naturally monopolistic. This tendency may be conservatively restricted to given areas but its existence is unquestionable and must be considered. The move toward combination of former competitors in most European countries has been accompanied by great economies and has resulted in more effective support from the large industrial interests.

Connected directly with the cost problem is that of developing a satisfactory commercial plane. No really satisfactory commercial transport airplane has yet been developed. Its development involves the following factors:

1. High pay load per horse power installed.
2. Large comfortable cabin.
3. High cruising airspeed with a low landing speed and a good rate of climb on take off.

So far, the above has been an impossible combination. Some one or two of the factors has been necessarily neglected with a consequent reduction in commercial efficiency. A part of this problem has been that of the suitable number of engines. Anywhere from one to four are in use and it seems that up to the present the single engine

planes are most reliable in service.[5] A new type of three engine plane, designed especially for commercial use is being built at the present time and great things are hoped for it.

The fitting of the plane to the particular type of service is also very important from the standpoint of efficient operation. An airplane designed strictly for goods service will save 5 per cent or more of the light weight of the same plane equipped for passenger service. Use of old war stocks and the general attempt to combine both types of service has resulted in less economical operation on this score.

There has been extensive discussion as to which is the best plane, all metal, "stick and wire," or welded steel tube. Various countries seem to be prejudiced in favor of a particular type. It is felt that the life of a duralumin plane must be measured in thousands of hours but the cost of such a plane is greatest. The following are some of the factors that must be considered in choosing the most economical plane:

1. Initial comparative investment.
2. Rapidity with which vehicle may become obsolete or inadequate.
3. Ease of maintenance and repair facilities along the route.
4. Character of likely weather.
5. Availability of shelter.

In the last analysis it is net earning power that counts.

Adequate insurance has been one of the cost "bugbears" of commercial operators. Full protection constitutes:

Property coverages on Plane and Cargo against,

1. Accidental Damage.
2. Fire.
3. Windstorm.
4. Lightning.
5. Burglary and Theft.

Third Party Coverages.

1. Public Liability.
2. Property Damage.
3. Workmen's Compensation and Employers' Liability.
4. Legal Liability for Passengers—for injuries.

Personal Coverages.

1. Life Insurance—pilots, operators and passengers.
2. Accident Insurance—pilots, operators and passengers.

This last is necessary because, with very few exceptions, passengers nullify any recent personal insurance during aircraft flight. While the first two groups are direct costs of production, provision of the last at reasonable rates is a problem vitally connected with the welfare of the enterprise. Non-fixed-base or "gypsy flyer" operations, and the necessary dependence on meager war experience statistics have made insurance rates practically prohibitive. Many operators have been following the dangerous practice of carrying their own risks with the almost surely disastrous results that eventually accompany such a practice. The insurance outlook in the U. S. at present is brighter than it has been for years, however. The close of the pioneer years 1919, 1920 and 1921 found all of the companies abandoning the field to "The Travelers." This lone company persevered right through to the present and has been recently joined by The Indemnity Company of America and The Independence Companies. It is hoped that others will forget their "gypsy" experience and soon re-enter the field.

Schedule maintenance has been mentioned as most important. This means a reserve of at least 30 per cent of the planes in daily flight. This adds another cost to any sound operation estimate.

[5] Van Zandt, J. P., *Report on Commercial Air Transportation Activities in England, France, Germany and Holland*, p. 6.

Along the same line is the thus far purely theoretical problem of flying equipment depreciation. It will be recalled that this was mentioned as one of the factors to be considered in choosing a plane. There is practically no agreement as to what constitutes the life of an airplane. Early estimates placed this at 200 to 300 flying hours whereas a number of planes have been kept in operation over 1500 hours and are still in excellent condition. Obsolescence usually overtakes a plane before depreciation. Some consider the vital cost problem to be "the useful life of the plane," which is a function of the total time involved as well as the number of hours in the air; if airplanes could be operated as much as 10 hours per day, they might last from 5,000 to 10,000 flying hours.

In the vernacular of the insurance companies "everything depends on the pilot." The expense of good pilots is a cost that cannot be shirked. Most European pilots average around 600 flying hours per year and this is considered as not far short of the normal capacity of the commercial pilot. Some idea of the pilotage expense may be obtained from the annual average earnings of $6,760 per pilot for an organization employing 46 regular pilots.

The foregoing discussion has attempted to throw some light on the purely cost considerations. It will be remembered, however, that many economists consider any economic discussion a value discussion. Value has always its two sides, supply and demand. The supply side is largely made up of cost consideration. But the demand side is inextricably bound up with the supply side and thus with costs. This interdependence will prevent any absolutely clearcut divisions in the discussion of aircraft transportation economics.

The Demand for Aircraft Services

The demand for the services of aircraft can be roughly placed in four categories. These are mail, express cargo, passengers, and general industrial service. Wise operation would seem to call for the seeking out of the most profitable class in a given locality specializing in it and devoting any surplus energy to the others. This is not always possible in a new industry because of the risk involved in specializing in a field where the experience data is most limited at best. This situation probably explains why companies have felt it necessary to spread their energy "over all fours" and thus lose a great deal of the benefits unquestionably redounding to the specialist.

It is felt that carriage of mail and express cargo is more generally profitable than catering to passengers. There is little doubt that mail and cargo will seek out and utilize any transportation service that offers reasonably regular and safe increased speed. Pound for pound, mail will pay in general a higher tariff than passengers. Operators throughout the world are learning that carriage of air mail and cargo does not involve the troublesome and often costly considerations of accident liability claims, of air sickness and the extra weight for passenger comfort.

But express business must be coupled with expedited handling at the airports as most of the time gained will be lost if the usual channels of land transport are used. Aircraft operators will find it most wise to make definite agreements with local express companies.

It is difficult to estimate the value of the service performed by aircraft carriers in the rapid transportation of blue prints, small parts of machinery, flowers, etc. "The saving in interest

alone resulting from the more expeditious transmission of banking documents through the air mail is an indirect saving of many times its cost."[6]

There are also many indirect gains from the speeding up of banking operations and the lessening of credit risks.

Lower insurance rates for air than for boat and rail transportation in Europe, for such shipments as dresses, furs, jewelry, fragile goods, light machinery, etc., seem to indicate a smaller handling and theft hazard in this newest form of transportation. Of course it is questionable whether such would continue to be the case if the large scale operations of rail and water were found in air transportation.

From the passenger's standpoint aircraft transportation has some desirable features. Business men are able to extend the scope of their operations. The tourist, however, has been the main user.

Among the important industrial uses to which aircraft have been put, and which will naturally be of interest to aircraft carriers as a means of utilizing temporarily idle equipment, are the following: entomological work, crop estimating, surveying, topographical work and general perspective, photography, forest patrol and fire fighting, advertising, etc.

Finally we come to another "borderline problem." There is no doubt that international trade is economic, but it is also tightly bound up with political considerations. Aircraft transportation has been typified as a business of great distances. This necessarily involves, in most parts of the world, operation over and in different countries. We do have instances of international co-operation, by the alternate supplying of service by the companies of two countries. But more often we have cut-throat competition and open hostility. The latter caused one French company alone to lose twelve airplanes in one year as a result of forced landing on unfriendly, not enemy, soil. Sometimes it is the problem of contraband goods that arouses this hostility, but more often it is the result of each country's desire to develop its own national air transportation resources. Part of this problem has been solved by international agreement, but any international business should always be aware of the fact that its field of operations is probably the most dynamic of any. While this situation may be conducive to exceptional profit it is, at the same time, pregnant with risk.

[6] Herbert Hoover, in House of Representatives, 68th Congress, hearings on H. R. 10522.

EXPERIENCE OF VARIOUS NATIONS

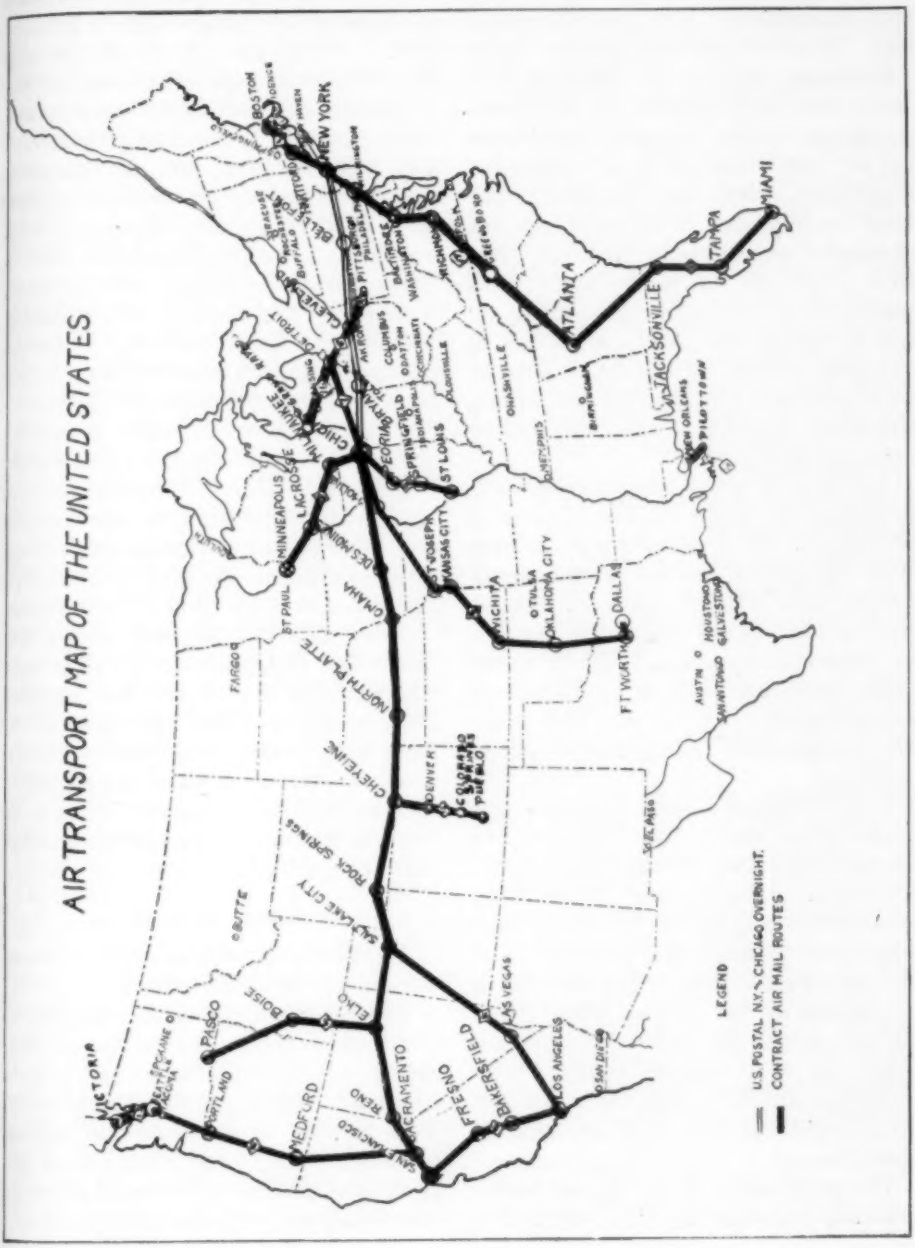
Practically speaking, the aircraft transportation experience of the United States (and possibly Australia) is the only experience which one can discuss as segregated and independent. Another examination of air maps will show us that European experience must be considered as a unit as well as a combination of distinct units.

This does not mean that there is any extensive international co-operation. Where such co-operation is present we can always see the hand of absolute necessity, either economic or political. And this is little more than should be expected. After the trying war and pre-war years of enemy and ally hostility and distrust, it is little wonder that the various nations' jealousy promoted this war proven asset, aircraft transportation.

But aircraft transportation rests its case on speed, and speed ever seeks long distances to show its powers and possibilities. And so we find the most bitter enemies (France and Germany)

finally being forced to limited accord by economic necessity. Thus an examination of Europe on a national basis becomes of necessity an international examination, despite the most earnest attempts at segregation of data.

It will be recalled that the outstanding characteristic of European aircraft transportation is generous subsidy. This means that not one line in Europe is on a paying basis. Such a condition vitiates any value in a comparison of



rail and air rates, because, in practically all instances, air rates are based on the general principle of "what the traffic will bear." Contracts for goods traffic on routes such as Paris-London, where competition is keen, are often placed at rates far below the actual expense of transportation. Despite this condition Investigator Van Zandt says: "European experience presents evidence that it is possible for air transportation under suitable conditions to be conducted with a degree of regularity, safety and dispatch sufficient to establish it as an important channel of commerce in the transportation resources of a nation." This statement is probably prompted by the fact that the heavy investors in aviation in the important European countries are the leading industrial, shipping, banking, and forwarding organizations.

The fact of great European growth in the last five years has been discussed heretofore. It is interesting to note that this growth has not been uniform among the various nations. Great Britain has always led in the number of passengers carried, but is being pushed rather hard by rapidly developing Germany. France has first place for accumulated mileage and goods carried.

Great Britain's lead in passenger traffic is not due to the fact that her people take to air transportation most naturally. As a matter of fact they are excelled only by the French in their reluctance to leave the ground. The Germans and Dutch people are said to be natural air travellers. Great Britain's passenger traffic has been largely made up of American tourists who probably desire to get their socially necessary thrill over with as soon as possible.

The regularity of European traffic generally is a mooted point. Optimists and promoters claim it to be very regular but sometimes qualify their remarks by, "as regular as could be expected," or "regular in summer." Pessimists, and many Europeans in particular, claim that its regularity is far from desirable. Even statistics on this point must be taken "with a grain of salt." They do not usually include the number of trips scheduled but not commenced, due to bad weather and other causes. It must be remembered that the northern part of Europe is subject to fog a good part of the year and this materially interferes with regularity. England and Holland in particular are sufferers on this score, and their irregularity will probably continue to be a handicap to sound economic progress until radio signalling technique makes further advances.

Closely connected with regularity and completeness of service is the problem of night flying. Experiments have been being conducted on the London and Paris routes as well as on the Berlin-Copenhagen-Stockholm, the Belgrade-Bucharest and the Paris-Prague routes. But development along this line will probably have to await further international accord and co-operation because the political situation interferes with thorough ground organization. Perfected ground organization such as beacons, emergency fields, radio reports, etc., is an absolute essential of night flying.

Great Britian

The particular subsidy conditions of Great Britain are as follows:

The lines (excepting the Bagdad to Cairo which is operated by the government) are developed by a private company with a government subsidy. This subsidy is fixed at one million pounds sterling over a period of ten years, and divided into annual amounts decreasing proportionately.

The repayment of this sum is provided for whenever the final profits of the company are superior to a fixed scale.

The government controls the administration of the company.

The last point is important. Most European nations keep a large amount of control of the companies. Sometimes this has had bad economic results and sometimes good. One good result in Great Britain was the compulsory consolidation of former competitors into the "Imperial Airways, Ltd.," as of April 1, 1924. This effected many worth-while economies.

One result of this consolidation was an agreement with the Deutscher Aero Lloyd for more efficient handling of their joint route to Berlin. The companies fly in opposite directions each day and thus furnish a regular daily service at a greatly reduced cost.

Great Britain seems to have gone the limit in centralization and has suffered somewhat from the elimination of healthy competition and too close relationship between civil and military aviation. But this centralization has probably helped make possible its most thorough regulation, which many feel is largely responsible for the excellent safety record of English subsidized lines.

The British insurance companies are well organized and have likewise combined to handle aircraft insurance. This has resulted in better, cheaper, and more efficient service, which is an absolute essential for the sound development of an enterprise which is so naturally hazardous at best.

France

Any separate discussion of French aircraft transportation should begin with an understanding of the most liberal of subsidy policies found in that country. Most writers feel that France has suffered more as a result of the misuse of appropriations than she has gained from her leadership in mileage. The Franco-Roumaine company is one of the least profitable but its politically strategic position is the main excuse for its existence. The Roumanian, Czech-Slovak, Polish, and Yugo-Slav governments all contribute to its support.

The general subsidy conditions are as follows:

French lines are operated by private companies with government subsidies which are accorded in the forms of premiums.

Purchase Premium on the cells and motors, equal to half the cost.

Distance Premium, in proportion to the number of kilometers covered and the amount of tonnage carried.

Administration Premium, fixed each year for each company.

Profit Premium, proportionate to the excess of receipts over expenditure.

Supplementary Distance Premium (equal to 50 per cent of the distance premium) in order to balance the development account of the Company if it is in debt.

Government participation in eventual profits from development is provided for according to certain conditions.

The State controls the administration, finance, and bookkeeping of the companies. The "Conventions" are signed between them and the Government (up to the present, annual and in the future, decennial).[7]

Besides the above, France has been most liberal in its indirect subsidy provisions. At Le Bourget, the terminal airdrome for Paris, eleven reinforced concrete hangars have been built and are rented at nominal amounts.

[7] For further discussion of European subsidy conditions see the International Chamber of Commerce Supplement to No. 3 of the Journal.

It is known that all of this liberality has its basis in the desire for military strength, and it is generally felt that this is responsible for the hostility that the French lines have had to cope with throughout Europe, particularly in Germany and Spain. It was the Franco-Roumaine line which lost twelve planes in 1923 as a result of forced landing in Germany. It was not until May 8, 1926 that France, Germany and Belgium finally reached agreement as to reasonable aircraft intercourse.

This agreement will possibly put French lines on a sounder economic basis. They too have been consolidated. Five lines are at present operating under the subsidy conditions outlined above. It is hard to say which has the brightest prospects. The Latecoere Line to Morocco has the best record for regularity and mail carriage. This line also traverses such long distances that the large saving in time makes small delays of less importance. But it is faced with the difficulty "that Morocco and Algeria are not of sufficient industrial importance to support an air service of the magnitude required. . . . To circumvent this situation Latecoere is actively promoting an extension of the Moroccan line down the African coast over 1,000 miles to Dakar there to connect with South American mail and passenger steamers."[8]

France enjoys one advantage over the rest of Europe. It is the main exporting center for valuable articles of small bulk. Aircraft transportation is so costly that its main resource will long be such "de luxe" traffic. The French failure to build up a helpful mail traffic is probably due to the fact that the service, except Latecoere's, is too irregular. Another explanation is the old one of international strife, which must be overcome before mail service can be made acceptably efficient.

French insurance (and thus reliable operation) has been aided greatly by careful inspection of planes by the "Bureau Veritas" a semi-public organization. But the service is not on a par with the British. One bright spot for the operators, however, is the law of June 3, 1924, which establishes the freedom of the air company from responsibility for goods or passengers, if so declared on the ticket or bill of lading. This materially reduces the carriers insurance cost and puts him on a somewhat firmer competitive basis.

Germany

When one thinks of Germany and air transportation the name "Zeppelin" probably comes to mind. There is little doubt that the Germans have made the greatest progress in the development of lighter-than-air craft. It is even claimed that Germany just before the war operated a regular commercial Zeppelin service between Cologne and other Rhine cities. But confirmation of the existence of such services at the present time is lacking. The technical economics of lighter-than-air craft has been treated extensively by one German writer but the extent to which this has been put into practice is uncertain. The recent transfer of most of the Zeppelin production interests to the United States seems to indicate a shift in the location of future development. It might be said, in summary, that lighter-than-air commercial operation calls for a much greater capital investment and a larger force of technical and operating experts, which combination would seem to oppose any rapid development.

German subsidy conditions are probably more conducive to sound progress than those of any other European na-

[8] Van Zandt, J. P., *Latecoere Air Lines*, August, 1925.

tion. They are granting subsidies for the transportation of mail bags and for the replacement of material. The air mail allowances are a fixed amount based on the number of flights and the useful carrying capacity of the plane operated on specified routes during six months of the year. The company agrees to carry up to a maximum of 100 kg. of mail per trip, if it is offered. The actual receipts from the sale of air mail postage go to the state, so that when the average load of mail develops to 100 kg. for each flight undertaken, the government will receive an income proportionate to its payments to the air transportation company. This is now practically a pure subsidy.

Formerly there were two controlling lines in Germany, the Deutscher Aero Lloyd Aktien Gessellschaft, and the Junkers Luftverkehr. The former was the result of the amalgamation, on February 6, 1923, of the majority of independent air lines. It was backed by such interests as the following: Hugo Stinnes, Thyssen, A. E. G., Hamburg Amerika, Nordentscher Lloyd, Robert Mayhoefer, and the Deutsche Bank. The latter was unique in that it was controlled by an aircraft manufacturing company and operated to create a market for the sale of its airplanes. These both had various subsidiaries in other countries, particularly Russia. Great economies were probably effected by the consolidation of these two major groups into the Deutsche Luft Hansa during March, 1926. This probably gives the Germans the most powerful single air transportation line in the world.

The fact that the German lines under least liberal subsidy have operated with a better safety record than the French, and at the same time more economically, is probably the result of their superior organizing genius which is everywhere apparent.

The occupation of the Ruhr gave a rather unique impetus to aircraft transportation, and illustrates the occasional advantage the possession of such a service may afford. When the French practically stopped all land transportation to and from the Ruhr there was an extensive heavy goods air traffic built up between London and Cologne.

The greatest German handicap has been the limitation on size and power of aircraft imposed on them by the Treaty of Versailles. With the removal of this limitation in the supplementary agreement of May, 1926, the German aircraft transportation business received its greatest impetus toward sound development. If the Germans succeed in operating the proposed 5,000 miles service between Berlin and Vladivostok they will reduce a 13½-day trip to a 50-hour trip. This would be as epoch-making event in their progress in the East.

German insurance is taken care of by a very close pool. Its statistics are kept secret, but it is known that German planes enjoy very low rates as a result of their fine safety record and the legislation favoring the common carrier. This is one of their many cost advantages in international competition.

Holland

The only other European country deserving separate discussion of its aircraft transportation activities is Holland. The Dutch services are unique in that they were started by business men as a purely business proposition, and were not subsidized until after they had been running long enough to prove that this was too great a handicap under present European conditions.

The subsidy was fixed arbitrarily at a maximum of 1,400,000 florins (about

$560,000), and divided into annual amounts which were to be eventually reduced according to the profit and loss account of the company.

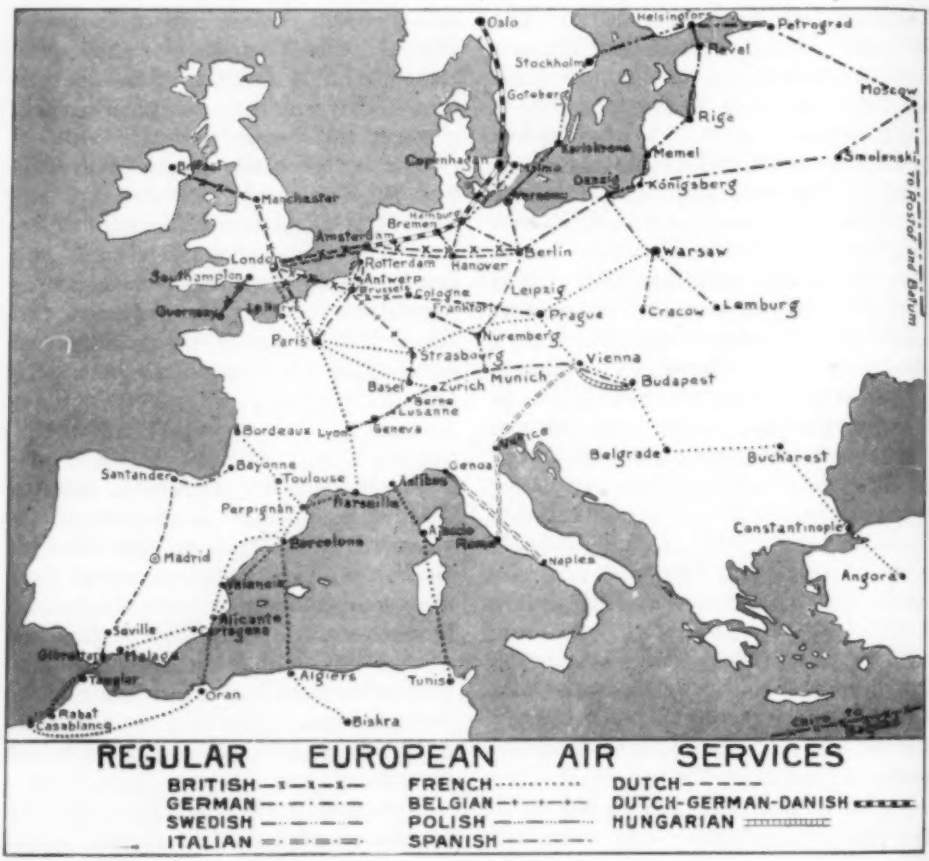
The repayment of this amount to the government was to be provided for out of the profits.

The government controls the administration and bookkeeping of the company.

The conditions of the subsidy are not very exacting, which probably helps to explain the fact that they obtain a higher percentage (40 per cent) of their operating expense from operating revenue than any other line in Europe. Another explanation of this efficiency is probably the fact that the Royal Dutch Air Service has steadfastly refused to engage in speculative ventures for advertising purposes, with the single exception of the Dutch East Indies flight.

The fact that 12½ per cent of schedule flights are wholly or partially prevented on account of bad weather, indicates one of the main handicaps air transportation suffers over land and water routes in Holland. Despite this bad weather Holland has a good safety record and even indulges in the usually precarious undertaking of self-insurance. The company sets aside each year a reserve (probably a bookkeeping one) equal to about 25 per cent of the investment in flying equipment.

Other countries in Europe have enjoyed negligible development or their



lines are tied up with those of the four countries discussed above. It is certainly an unusual and interesting situation to have three or four countries contributing to the support of another nation's transportation service.

The United States

The United States is noted the world over for the remarkable achievements of the air mail ever since its inception at the close of the world war. Since 1922 the miles flown per crew fatality are greater than those flown by England or France. This is the only personal safety comparison possible because, until 1926, the air mail did not carry passengers.

It also had a remarkable record of reliability. A two-year comparison of scheduled trips completed on time on the New York to Chicago Air Mail service, and with the number of trains in New York State arriving on time at division terminals during 1910–20 inclusive, gives interesting proof of this reliability. Based on a ground speed of 70 miles per hour, the mail planes show "on time" averages ranging from 73 per cent in winter to 97.8 per cent in summer during a two year period. Passenger trains operating on a schedule *half as fast* show averages ranging from 75.3 per cent to 85.3 per cent. Another interesting comparison of reliability is the following: "The U. S. Air Mail for the three calendar years 1922–24, inclusive, transported 159,843,096 letters, of which only 125 lbs., or approximately 5,000 letters were lost or destroyed. This number is about half the percentage of losses of registered packages transported by U. S. railroads.[9]

The air mail has been supported by annual credits granted to the Post Office Department by Congress. These credits for 1925 were approximately $2,750,000. The expenditures for 1925 were $2,743,750.81, while the receipts from postage were only $602,627.54. This shows the air mail to be far from a self-supporting basis, especially when it is remembered that a number of operating costs are not included in the Post Office statement which a commercial company would have to make due allowance for—namely, expenses involved in soliciting traffic, legal expenses, depreciation, insurance and so forth. The fact that the air mail has suspended services started in various parts of the country because of their apparent inability to ever become self-supporting indicates, however, that an earnest attempt has been and is being made to put the service on as sound an economic basis as possible. While the night service has been particularly costly from the standpoint of lighting equipment, extra pilotage pay, etc., it has been felt that this service supplies a fundamental need and will do a great deal toward putting the air mail on a paying basis.

U. S.–Private Carriage of Air Mail

On February 2, 1925, the Kelly Bill was passed by Congress authorizing the carriage of mail by private enterprise at rates of postage of not less than ten cents per ounce. Under its term the Postmaster General may also contract for the forwarding by aircraft of first-class mail other than air mail. In either case the contract price cannot exceed four-fifths of the revenues derived from the mail so transported. It also authorizes the Post Office Department to contract for the private operation of existing routes and to establish additional routes.

Another bill was passed in 1926 establishing an assistant secretary of commerce in charge of aviation. His duties will be generally to provide:

[9] Department of Commerce and A. E. C. Joint Report on *Civil Aviation*, p. 64.

1. Aids to commerce, such as beacons, weather information and maps or route cards.
2. Certification of planes, licensing of pilots and establishment of routes.
3. Fostering of air commerce, mainly by making transportation safer and by making fullest and wisest use of present equipment.

It will be noticed that all of the aid authorized in the above two laws is indirect and looks toward practical self-supporting operation. Largely as a result of the passage of these two bills the following are some of the lines that have been organized and are operating regular services in the United States:

1. Boston-New York (Colonial Air Transport), 220 miles, begun July 1, 1926, 6 days a week, except holidays.
2. Chicago-St. Louis (Robertson Aircraft Corp.), 277 miles, begun April 15, 1926, 5 days a week, except holidays and day following.
3. Chicago-Dallas (National Air Transport), 995 miles, begun May 12, 1926, daily.

*4. Salt Lake City-Los Angeles (Western Air Express), 589 miles, begun April 17, 1926, daily.

5. Pasco-Elko (Walter T. Varney), 424 miles, begun April 6, 1926, 6 days a week.
6. Detroit-Cleveland (Ford Motor Co.), 91 miles, begun February 15, 1926, 6 days a week, except holidays.
7. Detroit-Chicago (Ford Motor Co.), 278 miles, begun February 15, 1926, 6 days a week, except holidays.

*8. Seattle-Los Angeles (Pacific Air Transport), 1,073 miles, begun September, 15, 1926, 6 days a week.

9. Chicago-Twin Cities (Northwest Airways), 384 miles, begun June 7, 1926, 5 days a week, except holidays and day following.

*10. Atlanta-Jacksonville-Miami (Florida Airways), 740 miles, begun April 1 between Jacksonville and Miami (393 miles), and September 15, 1926, between Jacksonville and Atlanta (347 miles), six days a week.

11. Cleveland-Pittsburgh (Clifford Ball), 115 miles, to start April 21, 1927.

*12. Cheyenne-Pueblo (Colorado Airways), 200 miles, begun May 31, 1926, daily.

13. Seattle-Victoria (Edward Hubbard), 78 miles, foreign air mail route operating 20 days a month, begun October 15, 1920.
14. New Orleans-Pilottown (Arthur E. Cambas), 80 miles, foreign air mail route operating 20 days a month, begun 1922.
15. Cleveland-Louisville (Kaess Aircraft Corp.), 342 miles, not started in 1926.
16. Detroit-Grand Rapids (Stout Air Services), 140 miles, begun August 2, 1926, every other day; beginning October 1, 1926, six days per week.

*Philadelphia-Washington (Philadelphia Rapid Transit), 107 miles, started July 6, 1926; discontinued November 30, 1926, daily.

*Philadelphia-Washington-Norfolk (Philadelphia-Rapid Transit, 234 miles, started Sept. 13, 1926; discontinued Nov. 30, 1926), daily.

17. New York-Atlanta, 744 miles (Pitcairn Aviation).

* Only lines carrying passengers.

These services are all too new to be able to make any examination of their soundness. Their contracts are all separate agreements with the Post Office Department limited only by the terms of the Air Mail Contract Law outlined above. The operators are allowed to carry express cargo and passengers and a reasonable amount of both of these will doubtless be necessary to insure their financial success. This is indicated by the fact that one operator sought government release from his contract shortly after making it. He said that one day's air mail from St. Paul, Minneapolis, bore $8

worth of postage, of which he received 48 per cent.

From 1921–24 the Aeromarine Airways, Inc., operated three scheduled passenger services: one connected Key West and Havana, and another Miami and Nassau during the winter; the third service operated during the summer between Detroit and Cleveland. Evidently the line did not pay because none of the services are in operation at the present time. There are a couple of short services on the west coast catering mainly to passengers and supposedly meeting expenses, but it is felt that the air mail contract system is the first real step toward the firm establishment of air transportation service on a commercially successful scale.

U. S.–Industrial Uses

The United States is probably foremost, however, in the use of airplanes for industrial purposes. Air cotton dusting for the boll weevil has proved cheaper and more effective than ground dusting. It has already effected a net saving of many thousands of dollars and it is estimated that this work could result in a maximum net saving of $135,000,000. The U. S. Bureau of Entomology is extending the use of the airplane to the fighting of other plant pests also. The United States Topographical Survey has plans to cover most of its field work by means of aerial photography. "It is estimated that the gross sales of three of the most active airplane photographic companies in this country amounted to $1,000,000 in 1925. Forestry patrol, fire fighting, and crop estimation work have all used planes extensively during these developmental years.

The step taken by the United States that will doubtless be one of the greatest long-run, sound influences was the establishment of the National Advisory Committee for Aeronautics by an act of Congress on March 3, 1915. While its primary function is to advise and investigate for the air services of the Army and Navy, it is authorized to furnish information, or conduct scientific or technical research for any individual in the United States, provided such individual defrays the actual cost involved. The committee keeps itself advised of research progress in other countries and releases this information to university laboratories and aircraft manufacturers. Its development has been similar to that of any other scientific body, slow, but this makes one feel that its progressive effect is assured.

Colombia and Australia

There is little information available about the Colombia and Australia projects, beyond the statistics already discussed. It will be remembered that the former is a non-subsidized service operated by German interests. It seems to be satisfying a vital transportation need which probably explains its self sufficiency.

The Australian lines are developed by private companies with subsidies from the Australian Government. Further extensions are planned and the subsidy expenditures are probably justified on the grounds that the various services promote the welfare and safety of the important mining communities and bridge over areas difficult to cross by ordinary means of transportation.

SOME INDICATIONS OF FUTURE POSSIBILITIES AND CONCLUSIONS

After an extensive trip over European airways a scientifically trained investigator made the following observation in 1925: "The operation of air transportation shows everywhere an encouraging increase in regularity and

safety, a growth in traffic and a decrease in unit operating costs. It is increasingly evident that the limits in regularity, safety, traffic volume and decreased costs have nowhere been reached and the curve of improvement is steeply upward." Another disinterested investigator confirmed these generalizations after a 21,000 mile trip during the first part of 1926.

It will be noticed that the points mentioned above are those that have already been discussed as some of the most crucial determinants of sound economic progress. The picture of what the future holds in store certainly seems bright. But there is one seed of decay that is still present and whose elimination must be continually attempted if the future development is to be increasingly more sound. Most of the present foundation has been built on subsidy. One needs but to recall that the French railroads and steamships have been subsidized for the fifty odd years of their existence, to realize that such paternalism practically always breeds comparative weakness. The railroads of many of the other countries of the world have long been self-sufficient. In these days of gigantic enterprises and large capital investment direct government aid usually seems the easier initial course. But large industries are continually being started by private enterprise and they are usually the better for it.

It is significant that not one active or potential operator of all those questioned during a recent extensive investigation in the United States desired direct subsidy. This portends well for the future of aircraft transportation in this country. If enterprisers are so convinced of the sound possibilities of a given venture that they are unanimously willing to assume all of the risk, there seems to be little question that they will overcome any temporary difficulties involved in economic operation.

It is not strictly true that they are willing to assume all risk. General navigation facilities involve too heavy an expenditure to ask them to make. It is interesting to conjecture on the degree of ocean transportation intercourse we would enjoy at the present time if the various governments had not long ago taken it upon themselves to make the seas as safe as possible. And we must always remember that economic progress requires specialization which in turn requires widening of markets. Man has always been relatively quick to intensively exploit any tools which will improve his economic status.

That aircraft transportation seems to be no exception to man's self-interest prosecution activity is borne out by many facts. Business men are everywhere taking an increased interest in air transportation. Many cities throughout the world have established and are establishing conveniently located municipal airports. Technical schools in the great universities are offering complete courses in aerodynamics and aeronautical engineering. Endowments have been created for the continuous study of economic as well as the mechanical aspects of the problems of aircraft transportation. Public governing bodies have been, after years of stirring, finally roused to the passage of economically sound legislation. International bodies have made some beginnings in bringing to an end the jealous, wasteful strife over air services between various nations. Much has still to be done on this score and much will remain undone as long as civil and military aviation have so much in common. The greatest international progress will be realized when the two are as distantly separated as possible.

In the light of the foregoing observations one cannot help but be optimistic about the future in those localities that realize the net burden of subsidy. Those who magnify the accidents and failures are similar to those who, less than a generation ago, predicted that the automobile would always remain a plaything. Those who count on unbridled optimism creating an immediately paying investment fail to realize the complexities of economic life in general. They forget that it must move more or less as a unit, that more costly transportation schemes must prove their power to add greater net value to the objects transported before their demands on our slowly increasing, usually busy fund of capital will be willingly met.

Air Transportation

By Anthony H. G. Fokker
Atlantic Aircraft Corporation

SIX months have seen a general change of mind with regard to aviation among the bankers, transportation people and business men of America. Of the possibilities of air transport and its vast ultimate utility no doubt now exists. Even the elderly, who personally hesitate at going up in planes, are convinced of their safety and necessity, and the younger generation adopts air transportation with enthusiasm, or more significantly, as a matter of course.

In War

This general change of attitude has had its effect upon America's valuation of aviation for national defense, but, speaking generally, the nation still does not fully comprehend the part which aircraft inevitably will play in future wars. This seems, indeed, to be grasped very slowly here. But understanding of course will come. The actual American demonstration of the fact, that battleships cannot resist and must sink under aerial bomb attacks, was as significant and dramatic as could have been the first startling achievements of projectiles propelled by exploding gunpowder in the first cannon. To the understanding mind that aerial demonstration was proof positive that in future warfare artillery will not play the dominating rôle, as it has in the past.

After gunpowder supplanted slings and catapults each new war effort showed great changes in the manner of its use, as for instance, the tiny cannon of the American Revolution as compared to the ordinance of the American Civil War. Evolution in the growth of destructive power during that period was startling, but the contrast between the heaviest Civil War period artillery and that of the World War was still greater.

Changes in aircraft will be as notable, and, because all life and effort have been speeded up, will be more rapid. Aviation with its present equipment can be regarded as only in the first stage of a technical development certain to be tremendous. The combination of aviation with modern chemical warfare, including the use of poisonous gases, indicates that in the next war not only the Army but (and chiefly) civilian populations of cities will be almost instantly affected by the first terrific destructive effort of the war.

This is realized in America by very few outside the ranks of experts, although some civilian populations of Europe (surely those of England and Germany), having had a taste of the horror of air warfare, are not deluded by the thought that safety lies in distance from "the front."

It may be possible that this combination of aviation and chemistry will prevent further wars after its effect has once been really demonstrated. If the war to end all wars ever comes it will be a war of aerial development.

I observed European aviation very closely during the war, because, naturally, my native country, Holland, was in a very difficult and even perilous position from the day of the Declaration until that of the Armistice. I am now, and quite as naturally, deeply interested in American aviation, for I have become a citizen of this great country. My wife is a Canadian.

It is here that all our future lies. We are intensely anxious to see the United States of America lead the world in peace-time aviation and to know the nation to be safely equipped with flying craft and expertly trained men in all military branches, so that in the event of war a competent and unbeatable defense will be absolutely certain. To a very great extent the military aviation of a future war will be dependant on the commercial air development of the nations involved.

THE U. S. AND EUROPE COMPARED

In spite of the splendid American Air Mail this nation lags far behind Europe in general commercial air development. Passenger-carrying equipment and organization virtually does not exist in the United States, whereas in Europe it has become one of the most important of modern activities.

I believe this lack of passenger-carrying facilities to be a serious handicap upon American business, and in many other ways a noteworthy strategical mistake.

If passengers could fly in the United States they would. That is proved conclusively by the fact that forty-eight per cent of the passengers who have been carried during the last year from Croyden, in England, to Paris, France, have been Americans. In Europe Americans eagerly seize the opportunities denied them in their own country.

Another proof that Americans are as anxious as anyone to fly, is that during the Sesqui Centennial Exposition in Philadelphia, while a passenger-carrying airline between Philadelphia and Washington was in operation, the large three-engine Fokker planes which flew the route twice daily were filled to capacity nearly every day and an average of 300 seats were booked in advance. Their capacity was small, only 8 passengers, but in four months they carried 3600 people—all that they could crowd aboard.

THE FUTURE

All except very short distance, high class, passenger travel will be by air in days to come. Transocean travel will be by fast aircraft almost exclusively. I am now building the plane in which Byrd is to attempt the transatlantic flight. It will be a good plane and, I think, not only with safety, but with unexampled speed, will carry him over the great stretch of waters which air transport will reduce truly to the proportions of a mere lake. In other words a few years will find transatlantic flight a matter of course. The Byrd flight will be a non-stop journey, by no means necessary, but calculated to advertise the safety of such travel most effectively. Probably the early passenger routes will be differently arranged.

That first attempts will all be non-stop is as it should be. This will attract wide attention as sporting propositions. Later organized effort will arrange for two stops to the New York-London and New York-Paris trips, the first of these in Ireland and the second in Newfoundland. Thus the journey will mean only fifteen hours above the water, estimating speed at one hundred miles an hour, a very moderate rate.

Technically nothing impossible or even especially difficult is involved in this non-stop flight. Planes already have been built that could have done it and that did do work as notable, and later established a 37-hour world endurance record. Macready and Kelly, for example, made a non-stop transcontinental Atlantic to Pacific flight in twenty-six hours and fifty minutes. The non-stop flight from New York to Paris would be but eight hundred miles longer.

The non-stop Paris to Djask, Persia flight, made last October by two Frenchmen, Rignot and Costes, was 3313 miles, or a fraction longer than the proposed Paris-New York non-stop flight.

PROGRESS IN AIR-MINDEDNESS

This summer should and will see a tremendous development of commercial aviation everywhere except in the United States, so strangely backward in this matter, and will show some development here.

Even the last six months has shown an increase in progressive air-mindedness among American business men in this regard, probably due to the great and spectacular success of the American Air Mail. A year ago a meeting of American businessmen asked to consider the financial wisdom of putting money into commercial aviation would have been scorned. Now money is available for every new and reasonably planned enterprise of this sort.

The ease with which people in this country now can be induced to try a flight in a plane is an amazing change over conditions which existed even twelve short months ago. Not only youngsters but the mature and even elderly are now eager to go up under any reasonably expert auspices.

Not long ago one of the great business organizations of Detroit (Continental Motors) bought one of my new three-motor planes. In it Mr. Judson, the president of the corporation, and Mr. Angell, its vice-president, flew from Detroit to the west coast by the southern route and back by the northern.

That was a try-out for the heads of the concern. It was so successful that this machine is now being used constantly in their organization, and soon Continental Motors will be steadily in the air as a matter of business efficiency. There are many other instances of this sort. Every large corporation, which covers great areas in its operations, is considering the advisability of aerial travel for its important officials as a time and, therefore, money-saving proposition.

COSTS

All the influences which have made such developments a little difficult in the past, and still handicap them, seem to be vanishing. For instance the cost of airplanes is high now. A three-engine machine can be sold for $40,000, each engine costing $5000 if it is to develop 200 horse power.

But note the difference between cost of retail manufacture and cost of quantity manufacture. These engines, built by quantity production methods, ought not to cost more than $200 each. Thus great is the margin between experiment and going concern. In quantity production, twenty-five of these engines can be built for the present cost of one. We have done these things in motor car manufacture. When we do them in airplane manufacture we shall have planes in the air.

DEVELOPMENT A MATTER OF COURSE

It is curious that while here we seem to be doing nothing, in Germany and France the development of air transport is as much a matter of course, as normal a business interest, as railway development was in the days of its beginnings. Berlin is a vast airport. Paris is a vast airport. London is a vast airport. In London a subway soon will be running directly from the center of the great metropolis to the landing field. This is not a madman's dream. Work has been begun upon this subway and is being rapidly pressed toward completion.

Why are we doing so little in America?

In Philadelphia, after the success of the Philadelphia-Washington Sesqui Centennial experiment, which I have mentioned, the Philadelphia Rapid Transit people expressed willingness to put ten million dollars into the establishment of a regular line, but could not get the necessary government guarantee of business.

The present cost of airplanes is high because thought concerning new types and improvements of old ones advances rapidly. It would be folly to say that this stage of airplane development has come to an end here or anywhere, but its influence will be constantly less as time progresses.

We already have established really efficient engine types, worthy to be put into quantity manufacture.

QUANTITY PRODUCTION

The whole engine development, which has resulted in the present advanced and admirable type, has occurred under the eye of the government and has been costly. But it must be remembered that military engines perforce will always be developed without regard to cost, but with the idea of obtaining the highest efficiency possible, regardless of expense. It is to be understood that designs thus developed are unlikely ever to be put into quantity production.

We in the United States shall not get the ideal aero-engine until the big manufacturers of motor cars take up the task of engine development. They will not do this until they feel sure of enough orders to justify continuous quantity production. As soon as this is possible, without the danger of being influenced by government requirements, we shall have quantity, in other words cheap production of airplane engines. Commercial aviation does not need engines of the ultimate possible performing power, as military aviation does.

The reliable and comparatively cheap quantity-produced engines for commercial aviation in America will be constructed, among other things, for overhaul at the minimum number of man-hours, and with interchangeable parts cheap to replace. Once this is started the engine which at present costs $5000 will be sold for $1000, with this price dropping rapidly until the irreducible minimum of a very few hundred dollars is arrived at.

After we begin quantity manufacture on truly American lines, as we now produce automobile engines, European manufacturers, unless heavily subsidized by their governments, will find competition with us utterly impossible, and will have to buy of us. Europe is a retail region, full of inefficiencies.

One of the most successful European air-cooled engines is built in five factories, instead of in one as it should be, each factory in a different country, with the total production of the lot smaller than a big American automobile engine factory, and serving in all five countries of a total area smaller than that of one American State.

Nobody knows better than I that construction methods may be widely changed. The larger factories will standardize their types. It may be that the use of wood and fabric will eventually be superseded by metal, provided some durable method of preventing corrosion and checking the destructive influence of vibration can be devised.

At present the production of metal planes is far from cheap. The duralumin sheets must be bound together with thousands of hand-made rivets of a type not to be manufactured by machinery. This will need to be, and will be, substituted by other materials and methods of construction. Eventually all-metal planes will be cheaper than any other.

The all-metal plane now is financially impossible for any manufacturer except, possibly, Mr. Ford, who seems to be willing to donate forty or fifty thousand dollars to every customer. Every other all-metal manufacturer has had to be re-financed several times, or supported by government contracts at excessive prices.

The growing aircraft industry will develop different types as the automobile industry has done. We shall have planes for every purpose, from the smallest two-seater or single messenger-plane up to the 100 passenger transport airliner, fitted with every possible comfort for its passengers.

As these things come about the cost of air transport will drop. If the cost of airplanes is one-tenth or less of what it is today, and if planes are adapted to the use of a fuel cheaper than that which at present they must burn, as is promised by our never-resting chemical industry, air travel may be cheaper than the present railway rates, while, at the same time, offering such superior speed and comfort that there will be no comparison on that score between the two modes of progression.

FAST PLANE TRAVEL AND SLOW TRAIN TRAVEL

Air transport will dominate the country, the railways being kept busy with mass-transport of passengers and freight. I do not believe that any single railway official in the United States today realizes the influence which the development of air transport is bound to have on all de luxe passenger transportation.

Railway experts, like the general public in America, have failed to understand the improvements in sight, or already actually realized in air transport methods. We Americans who have travelled by air abroad (and thousands of Americans will be doing so this summer) know the superiority of the plane over every other vehicle, especially for night travel. There is no comparison between the smooth delight of the aircraft cabin bed and the rocking, ever shifting couch of a night traveller by railway train in the very best Pullman cars over the most perfect roadbed.

The airplane is at present noisy, but it is certain that this noisiness will be very greatly reduced, and the monotonous noise of a plane encourages sleep and is not tiresome.

The cost of equipping airways is infinitesimal by comparison with that of building railways and establishing their terminals. Even though the most perfect lighting and radio-direction systems be installed this will always remain the case. Where railways have to cross rivers or mountains vast expenditure must be involved. A river or a mountain chain adds not a penny to the first or any other cost of air transport. Railway rights of way through crowded cities are inconceivably costly. Air travel needs no such rights of way. And the multiplication of speed will lengthen the traveller's life by just the number of days, hours and minutes that fast plane travel saves over slow train travel.

AIR TRAVEL WILL SUPPLEMENT RAILWAY TRAVEL

As has been learned in Europe, however, air travel will not compete with, but will supplement railway travel. The railways should be first to take up and encourage the establishment of airlines. If they have the wisdom to do this they will have absolutely nothing to fear, but, on the other hand, will prepare for a new source of profit. At first they tried to deny the efficiency of long-haul motor vehicles, until soon they found the truck cut-

ting in upon their freight business and the busses reducing their suburban passenger haulage. Then, in many regions, they did the sensible thing—they went into the trucking and bus businesses themselves. Now they are making more money than ever.

Exactly similar should, and will, be chapters in the story of the railways and air travel.

The effect of air travel upon many things will be magical in the United States. For example it will immensely increase the commuting distance of the businessman. Imagine the effect which it will have upon the real estate value of islands.

We are but a step or two away from such a development of air travel as will be epochal in the nation's history. Really it principally waits for the perfection of air terminals in all cities. With regard to this a very encouraging picture has been presented during the past year. The completion and enlargement of air terminals will have the same effect on air travel and the plane industry as the building of good roads had on motor travel and the automobile industry.

The time is close at hand when each city will not only have its landing field, but will be encircled by a belt of landing fields, each connected by good transport with the town's center. Few cities already grown to any considerable size can arrange landing fields within their inner boundaries, and it is probable that if any did so they soon would find such fields so congested that they would perforce have to be transferred to the outskirts.

It is astonishing that the vast city of New York has actually not a single landing field.

When travel by airplane is organized here it will offer American sightseers such opportunities of inspecting the United States as they never have dreamed of. And imagine the comforts of their travel, with surface difficulties entirely negligible!

Air travel will not have been under way here very long before every city and town will realize that it must be reckoned with in town-planning.

ADVANTAGES NOT YET REALIZED

Many advantages of air transport are not yet at all realized by the general public. Not only does it need no roadbed but it can be operated from and over land or water, ice or snow. No degree of heat or cold affects it.

The time now has come when these and many other things must be laid before, and carefully considered by, the American public unless this great nation is to be left far behind by its competitors in the great race of progress. Transport is the most important detail of the processes of civilization. Air transport long since has passed the experimental stage. There can be no further doubt about its safety, comfort, and superior speed.

Its development only needs such organization here as will come automatically through the investment of capital by those who have earned that capital through their own hard effort. Such capital is far more valuable than any other.

There can be no further doubt about the safety, comfort, superior speed, and its dominating influence on transportation and warfare.

But all will be surmounted. The airplane is especially adapted to surmount all obstacles.

Book Department

WILLIAMS, JUDITH BLOW, PH.D. *A Guide to the Printed Materials for English Social and Economic History, 1750–1850.* 2 Vols. Pp. Vol. I, xix, 535; Vol. II, 653. New York: Columbia University Press, 1926.

This very excellent guide is the result of hard work, good judgment and sound critical scholarship. With this there is also combined a good understanding of the larger movements of English history for the century from 1750 to 1850. The importance of the period is generally recognized. It encompasses the Industrial Revolution, which according to the conception of the author forms the bridge, as it were, between "the relatively local and small scale life of earlier days, and the more intricate economic and social life of modern times."

The works are grouped in three divisions. The first relates to the Industrial Revolution as it is usually understood; the second to the expansion of England's possessions overseas, and the third, to the economic and social effects in England of the Napoleonic Wars.

The plan of the work is simple. Part I deals with works of general reference, classified under Bibliographies; Encyclopedias; Economic and Social Histories; Political Histories; Publications of the National Government; Local Records; Reports of Societies; Periodical Publications; Works of Travel; Local Histories and Biographies. Part II is devoted to special subjects as follows: Economic Theory, Economic Conditions, Industries, Social and Economic Conditions and Movements, Social and Political Theory and Movements. These are followed by a detailed index of authors and a well organized guide to subjects.

In order to secure a body of material with unity and coherence, yet representative of the period, the author used two principal themes as the basis for the sections and the organization of the sources. The first, to use the author's own words, relates to "population, prices, business, cycles and crises, commerce, money and banking, public finance, transportation, industry and technical developments affecting it;" the second to social relationships, that is "the conditions of life, especially among the working classes, wages, the poor, charity, co-operation, trade-unions, education and theories of social reform."

It is evident from the selection and classification of subject matter that the treatment is closely articulated to the simple and more general outlines of the history of the period, rather than to a preconceived and artificial bibliographical scheme. Publications of the same general type are grouped together. Bibliographies, official and periodical publications usually come first in each section, other works following in chronological order.

A noteworthy feature of the work is the effort at an appreciation of evaluation of the works in the form of brief notes and comments which are as a rule, penetrating and critical, and as the author tells us, based on actual handling and reading of the books themselves. As a result the estimates always command consideration, even though one may at times differ from the opinions expressed.

In the matter of selection the specialist will frequently experience unexpected surprises both in the works included and in those left out. For example, either through oversight or mistaken judgment, the very important work of "War in Disguise" (1805) by James Stephens, and its American reply entitled "An Answer to War in Disguise" do not appear; nor does "Dangers to the Country" written two years later. Similarly, Melvin's work on the Continental System, a scholarly work based upon extensive research escapes notice. It is particularly unfortunate because of the valuable bibliographical section of Melvin's study.

The reviewer appreciates the extraordinary difficulty of the author's task and by way of extenuation for omissions of this kind, it is only fair to quote the statement in the preface that the guide is "selective" and that "not more than one-third or one-

fourth of the works examined have found a place in the work." The section on the "Publications of the National Government" will prove of special value to beginners.

The high standard set by these two volumes should be an earnest of the bibliography of English history for the larger field now in preparation by a group of scholars under the auspices of the two great Associations of Historians in England and this country.

In conclusion it is a pleasure to speak with unstinted praise of a work that reflects such sound scholarship. It is not only a valuable aid to historical students, but will prove a stimulating and helpful guide to researchers.

WILLIAM E. LINGELBACH.

HOAG, C. G., and HALLETT, G. H., JR. *Proportional Representation.* Pp. xx, 546. Price, $5.00. New York: The Macmillan Company, 1926.

For many years the standard classic on Proportional Representation, or P. R. as our authors prefer to call it, was John H. Humphreys' *Proportional Representation* (reviewed in *The Annals* of October, 1911). This was an authoritative book in which was analysed the results of English electoral methods; contrasted the working of the second ballot, the alternative vote and Proportional Representation; described the systems of election then obtaining in several Continental countries, in Tasmania and in South Africa; and discussed the effects of P. R. upon the party system and its bearing upon the relations between the two Houses of Parliament.

Humphreys' book must now yield its place to this new volume by the Honorary Secretary of the (American) Proportional Representation League (Mr. Hoag) and its Executive Secretary (Dr. Hallett) who have written an equally authoritative book, quite up to date and including the American experience of recent years which has been active and fairly extensive beginning with the adoption of P. R. in Ashtabula in 1915 and including elections on that basis in such representative cities as Cleveland and Cincinnati.

The chapter on "How P. R. Works" is indeed most illuminating and in many respects more effective than the one in which the authors deal with "Objections," as it is hard for zealous propagandists, and our authors are certainly such, to deal dispassionately with the arguments of opponents or the doubts of the thoughtful. The discussion of the objections is fair, but for the reasons noted is not forceful.

How P. R. has worked in hundreds of elections and places is told with adequate summaries of facts and references to sources. Full documentation is one of the admirable features of the book, nearly one half of which is given over to an Appendix which comes pretty close to being the most valuable part of the book. It contains a list of places and organizations using Proportional Representation; quotations from famous political theorists on the subject; the earliest treatise on it; a discussion of its constitutionality, a list of organizations promoting P. R., a discussion of the constitutionality of P. R. and of majority preferential voting and of election provisions for P. R. with the single transferable vote.

In the body of the book there is an explanation of voting systems that do not represent the will of the voter, a study of the two types of P. R. which have been widely adopted—the list system and the single transferable vote (the Hare system); their advantages and the objections to them, the history operation, and technical details. In short the book is designed, in the words of the authors to make it "of value to the people of the United States. The problems and experience of other countries have not been neglected, but their treatment has been subjected to the requirements of this purpose."

It is to be regretted that the index references are to sections rather than to pages as many of the sections cover a number of pages.

CLINTON ROGERS WOODRUFF.

OLSON, REUEL LESLIE, A.M., J.D., PH.D. *The Colorado River Compact.* Pp. xxiv, 527. Price, $8.00. Published by the author, Los Angeles, Calif., 1926.

The project of legislation discussed in this volume should occupy a distinct place in the constitutional history of the United

States. It remains a paper project. Five years have passed since the ambassadors of the seven states of the Colorado River Basin began their negotiations in Washington, more than four since they signed the compact at Santa Fé, but ratification by the legislatures of the states remains incomplete, and seems likely forever to remain so. Despite political and economic pressure from Washington, Arizona steadfastly withholds her consent for the very sufficient reason that she has much to lose and little to gain by giving it. The one great need which she was suffering with the other six states of the basin when the negotiations began was supplied before their conclusion by the Supreme Court of the United States —a certain and simple rule fixing the relative water rights in an interstate stream possessed by arid states each of which has abolished the water right of the riparian landowner and substituted the right of the prior formal appropriator. The decision in *Wyoming* vs. *Colorado*, 259 U. S. 419, setting up the same rule as to the conflicting claims of two states each of which has so legislated, was rendered June 5, 1922. It assured to Arizona—with the inducements to prompt development offered by her vast area of irrigable land and mild climate—the security of the titles of her appropriators who take while the taking is good, against attack by later comers to the high and colder valleys of the upper basin.

This great river of the Southwest, not inaptly called the American Nile, drains and waters parts of the states of Wyoming, Colorado, Utah, New Mexico, Arizona, Nevada and California. Rising at high altitudes on the western slope of the Rocky Mountains where the growing season is short and the frost risk high, it debouches upon the rich low, hot lands at the head of the Gulf of California where crops may be grown twelve months in the year. The Imperial Valley, 250 feet below the level of the Gulf, is the best known part of these lands. In the famous Canyon section alone it falls 3000 feet, in its whole course 8000 feet,—a vast potential source of water power. Like its African prototype, it suffers a regular annual flood from the melting snows of the Rocky Mountains, but with more disastrous results. Twenty years ago the entire river broke into the Imperial Valley and threatened it with complete destruction. After a desperate struggle the river was forced back to its channel; but the peril is ever present, and only flood control by gigantic storage works can adequately safeguard against it.

As if nature and conflicting state jurisdiction were not enough, the river presents international problems of the gravest character. Vast areas of rich Mexican lands about the head of the Gulf are held by American speculators. The Imperial Valley is watered by a canal which takes water from the river in the United States, carries it many miles through Mexico and back again into the United States. The part of the canal in Mexico is owned and operated by a subsidiary corporation incorporated in Mexico and obliged by its charter to furnish on demand as much water for lands in Mexico as for lands in the United States, an obligation which has never been fulfilled. For the protection of the Imperial Valley the United States has built and maintains a levee in Mexico. Finally, the storage of the annual flood, at the expense of the United States or of its citizens, would greatly increase the amount of water available for irrigation and would therefore increase the acreage irrigable from the river; and if the point of storage were as far down stream as Boulder Canyon, much of the water could be used only in Mexico. Many persons in the Southwest fear the establishment of a large Japanese colony in Mexican soil with a Japanese city at the head of the Gulf. Storage at the head of the Canyon section of the river would avoid these evil consequences and vastly increase the potential water-power development, but the feasibility of diverting the water there stored to lands in Arizona and California is in dispute.

The author is a professor of law in the University of Southern California at Los Angeles. His book is a Harvard doctor's thesis and is extensively documented. After a brief introduction he analyzes the compact and discusses at much length in separate chapters its engineering and economic background, and the constitutional and political issues involved in it.

The compact, unlike the pending Dela-

ware River compact, merely sets up rules of law for apportioning the water of the river, without establishing any administrative agency to apply them. In his concluding chapter the author finds this omission to be a fatal defect. Indeed he maintains that in time of scarcity "the prior appropriation system breaks down, and there must be a conscious control of the vesting of water rights in accordance with other principles. To the determination of these principles a Colorado River Authority might properly direct its attention. Their development is not the concern of anyone at the present time." But it is hard to see how Arizona could be induced to make so sweeping a delegation of its powers over the river and thus put at hazard a title made certain, as the state thinks, by the Supreme Court of the United States.

The reader will find this volume a useful abstract and compendium of the discussion that has raged about the compact rather than an authoritative judgment on the matters in issue. It is equipped with maps, a profile of the river, an airplane photograph of a section of the Canyon, a "Who's Who in Colorado River Development," bibliography and index.

PHILIP P. WELLS.

BERNARD, L. L. *An Introduction to Social Psychology*. Pp. x, 651. Price, $4.50. New York: Henry Holt and Company, 1926.

Social Psychology, as an academic subject, finds itself in a strange position. Everyone working in the social sciences is a social psychologist, whether he wishes to be or not. The economist may deny with great emphasis that he has any concern with social psychology, yet certain notions as to what human beings will do under certain circumstances is basic to all his thinking. Human motivation in stated social circumstances is the foundation for his whole structure of economic theory. And what is true of the economist is true of the political scientist, the sociologist and anyone else, whether "theorist" or "practical man" whose work requires an analysis of social situations.

How then is one to explain the low repute in which social psychology is generally held in academic circles? The explanation lies partly in the mass of controversial literature in this field, with its exaggeration and vituperation; partly in the enormous amount of pure rot and nonsense that has been offered to the reading public as social psychology; partly in the mistaken claim put forward that the whole domain of social psychology belongs exclusively to the psychologist, and that trespassers will be prosecuted. For many the controversy has been confusing, the nonsense disgusting, and the claims of certain individual psychologists consoling. For, if social psychology is a specialism in another field, then one need not bother one's head about it.

Two noteworthy volumes in social psychology have appeared in recent years, one by Allport and the other by Bernard. The former volume is written by a psychologist and is especially strong in its analysis of the individual personality and is weakest in its analysis of the social process. The latter is written by a sociologist who has devoted twenty years primarily to the analysis of social situations from the psychological viewpoint. Hence Bernard's volume is strongest in its analysis of human motivation in the social process.

Bernard is not easy reading; his mind is rigorously logical and abstract, and once a bit of ground has been covered he does not dally by the wayside with long illustrations or make excursions into interesting by-paths but proceeds immediately to the exploration of new territory on his general line of march. However, the reader is more than repaid for his difficult reading by the penetrating analysis of social processes. Moreover, an enormous amount of ground is covered. If Bernard's style is abstract it also flows smoothly and is perfectly clear and gives every evidence of a vigorous mind behind it.

Bernard's approach is the synthetic one. He is not interested in controversy. In an earlier volume, *Instinct: A Study in Social Psychology*, he entered the controversial field and showed the folly of attempting to explain human motivation in terms of a few well-defined instincts. His present purpose is to present the authentic material. He has been notably

fair in giving the contributions of those with whom he disagrees. It is evident that the writer feels strongly the desirability of clearing up the confusion existing in many minds as a result of all the controversy. In order to do this he plans to cover the field completely in two sizable volumes, of which the one under review is the first to come from the press. In the second volume Bernard will deal with the development of personality and the self and social consciousness.

The present volume is divided into three main sections: The Foundations of Collective Behavior; The Integration of Personality in the Psycho-Social Environment; The Psycho-Social Environment and the Organization of Collective Behavior. A fifty page introduction gives a broad setting for the material that follows and discusses the relation of social psychology to other academic pursuits. The general approach of this writer is quite different from the usual material to be found in this field. He does not discuss the "herd instinct," or some prepotent herding tendency, and then proceed to show how such *tendency* or *desire* or *wish* will work itself out in the life of the group. He believes the human animal is possessed of an extraordinarily adaptable organism and that the social process, within broad limits, selects the types of responses that will fit the pattern of life the group already has in operation.

A scholar once remarked, in delimiting his field of operations, that psychology was the study of the skin and what it contained. Bernard has reserved for another occasion his detailed subcutaneous explorations, or rather, he is more interested in what the world beyond the skin does to the world within the skin than vice versa. He has given us a scholarly and illuminating book and one that will doubtless receive increasing recognition as time passes.

HUGH CARTER.

THRASHER, FREDERIC M. *The Gang* Pp. xv, 571. Price, $3.00. Chicago University of Chicago Press, 1927.

This well-documented study of 1313 gangs of all age groups in Chicago analyzes the rôle played by the gang in the life of the adolescent boy, and in particular of the boy "who dwells among the shadows of the slums," where the poorer immigrant groups have settled. Here old and new standards have clashed. The process of adjustment has all too frequently meant a collapse of family life and parental authority, aided instead of prevented by a misdirected process of "Americanization." Here, "in the twilight zone of railroads and factories, deteriorating neighborhoods and shifting population," the gang flourishes. It is the product of a "geographically and socially interstitial area," a frontier phenomenon in the borderland between business and residential districts. To the adolescent boy in whom a new individuality is forming, moulded by strange and to him unknown forces, the gang furnishes an escape from an otherwise humdrum existence and a way of meeting needs which society fails to satisfy by constructive means. It becomes, therefore, a powerful influence in the formation of character. In some cases it aids the boy to become a good citizen. In most cases it demoralizes him. The chapters on the gang and its part in immorality, crime, and party politics testify to this.

The author suggests that the only way of making the gang a useful instrument of socialization is to provide its members with constructive interests without eliminating the thrill in the process. Occasionally this has been done successfully by the Y. M. C. A., the Boy Scouts, and the settlement houses.

Professor Thrasher has made a real contribution to sociological research. The wealth of material employed has been used with good judgment and presented in an entertaining as well as an instructive manner. It is unfortunate that the concept of the gang as an "interstitial" group has not been carefully and logically analyzed, particularly since it is regarded as the key to the situation.

The make-up of the book is attractive. Aside from a few omissions of references (for documents Nos. 68, 137, 159) and an incorrect footnote on page 62, it gives evidence of careful proof-reading. Some photographs, an excellent bibliography and a good index add to its usefulness. Those who come into intimate contact with the adolescent boy should read it. The gang

problem is unfortunately not limited to Chicago.

THORSTEN SELLIN.

JACKMAN, W. T. *Economics of Transportation*. Pp. 818. Chicago: A. W. Shaw Company, 1926.

Aside from three chapters in which inland water, express and highway transportation are discussed, Professor Jackman's work on the *Economics of Transportation* deals with the business and political aspects of railroad transportation. Its value rests chiefly on the very detailed information about Canadian railroads presented by the author, but it does not entirely ignore railroad transportation in the United States. Four chapters are devoted primarily to the discussion of freight rate structure in the United States and in discussing railroad regulation, Canadian and American practices are compared and contrasted.

Of greatest general interest, perhaps, are the sections dealing with public regulation and government ownership. Professor Jackman states that "to those who are familiar with the transportation conditions of twenty-five years ago and with those which prevail today, there is no doubt whatever that the Board of Railway Commissioners has been of untold service to all interests, including the railways," but his general reaction toward more comprehensive regulation is unfavorable. "The tendency in regulation is that it may go too far. There has been an opinion held by not a few people that the cure for the evils or defects of regulation is more regulation, as if the cure for the poison of the serpent's bite was more venom of the same kind. Regulatory control in Canada has not yet reached the stage which it has attained in the United States, and it is the hope of those who desire the welfare of the country and of its railways that this country may not follow in the steps of the neighboring republic in this matter." The opinion is expressed that the enforcement of all of the provisions of Canada's regulatory laws would leave very little initiative on the part of the railway management, but Professor Jackman states that some of the provisions, including those requiring the advance filing of tariffs, are not being enforced: "the fact is that in the hour to hour conduct of the railway business, tariffs are changed ten, twenty, or thirty times a day. Shippers call up the freight traffic manager on the telephone and rates are arranged that will enable them to do business. These facts may be somewhat of a revelation to some members of the board, but they are intended to indicate that when unreasonable restraints are thrown around legitimate business some means will be found to enable it to be pursued on a reasonable basis." A view such as this is in sharp contrast with rate tariff practices of the United States where the filing of tariffs before rate changes become effective and the obtaining of commission approval before the requirement of the Interstate Commerce Act prescribing an advance notice of thirty days may be waived, are regarded as essential parts of the laws prohibiting unlawful discrimination.

An extensive account of Canada's government ownership policy is given because "of all the railway problems of Canada, that of government ownership causes the others to fade into insignificance." As Canada's major government ownership program has been in effect but a few years no definite conclusions as to its success are stated. Recently announced net operating surpluses are discounted by "asking the question whether these are real surpluses or whether they appear as such in the accounting." The acquisition of the Canadian Northern, Grand Trunk and Grand Trunk Pacific is explained on the ground "that most of these railways were bankrupt, and the government, influenced, no doubt, by a clamorous public-ownership sentiment, determined to take them over. Previous and subsequent to their acquisition, large cash advances had been made by the government to keep the roads in operation, and these, together with the amounts provided in the way of guarantees and bonded debt show a very heavy investment of the people in the National Railways." The Grand Trunk and Grand Trunk Pacific purchases are specifically accounted for on the ground of financial difficulties that the companies could not surmount without further public aid; the belief that a receivership would be injurious to the credit

of Canada; an assumption that the people wanted government ownership; and a conviction in some quarters that these lines were essential to round out the government's railway system so as to enable it to compete with the Canadian Pacific. The development of additional traffic, the reduction of fixed charges so as to overcome the net deficits that continue to occur, the possible recapitalization of the National Railways, and the influence of sectionalism and politics are given as the principal general problems or issues that now confront the government owned lines of Canada.

Those interested in the railroad traffic and operating practices and policies of Canada will find much of interest and value in this book.

C. G. HUEBNER.

MOLEY, RAYMOND, Editor. *The Missouri Crime Survey*. Pp. xxvi, 587. Price, $6.00. New York: Macmillan Company, 1926.

MOLEY, RAYMOND. *The Administration of Criminal Justice in Missouri*. A summary of the Missouri Crime Survey. Pp. viii, 56. St. Louis, Mo.: The Missouri Association for Criminal Justice, Central National Bank Bldg., 1926. Free.

During recent years it has become almost fashionable to write on criminological topics and particularly on the causes of crime and their removal. In the great majority of instances, the writers have relied more on a fertile imagination than on a safe but prosaic body of factual knowledge. It is therefore a pleasure to read a work which makes no sweeping assertions, is based on carefully collected and analyzed facts, and makes no extravagant claims. *The Missouri Crime Survey*, the first state-wide survey of the administration of criminal justice in the United States, simply points out the defects in the surveyed organizations and their functions and suggests the best way of remedying these defects.

The survey, sponsored by the Missouri Association for Criminal Justice, was made in 1925 by a corps of trained investigators. It is "an attempt at self-analysis" and "not a probe or exposure." It is based on the fundamental principle in legal research "that what is most needed is not merely a study of laws but of laws in operation, not merely of rules of procedure but the manner in which these rules are used in the actual trial of cases." Using the records of 39 representative counties, the path of justice has been charted and the functions of its various guardians analyzed. For those familiar with the work of our courts and penal institutions it is probably no shock to learn that "the practice of the criminal profession is not unduly hazardous," that "the few who are sentenced to the penitentiary for serious crimes are relatively soon at liberty," that "a life sentence has come to mean eleven years," that "parole has been reduced to a mere method of turning criminals loose without any reference to the fundamental principles upon which parole rests," etc.

The report of the survey is divided into eleven parts: "The Metropolitan Police Systems," prepared by Bruce Smith; "The Sheriff and the Coroner," by Raymond Moley; "Preparation and Presentation of the State's Case," by Arthur V. Lashly, the operating director of the Survey; "Judicial Administration," by Arthur V. Lashly and J. Hugo Grimm; "Bail Bonds," by Raymond Moley; "Ten Years of Supreme Court Decisions," by J. Hugo Grimm; "A Statistical Interpretation of the Criminal Process," by C. E. Gehlke; "Necessary Changes in Criminal Procedure," by Herbert S. Hadley and Jesse W. Barrett; "Record Systems," by James E. Boggs and Wm. C. Jamieson; "Mental Disorder," "Crime and the Law," by M. A. Bliss; and "Pardons, Paroles and Commutations," by A. F. Kuhlman. Only the three last reports touch on problems connected with the institutional treatment of offenders.

It is impossible, without an extensive analysis, to do more than refer the reader to the report itself which is a mine of information of value to all students and practitioners interested in crime problems. It is a pioneer work of which its sponsors and authors can be justly proud.

For the benefit of those who desire a brief summary of the report, the Missouri Association for Criminal Justice has published a pamphlet for free distribution.

THORSTEN SELLIN.

PROCTOR, ARTHUR W., and SCHUCK, ARTHUR A. *The Financing of Social Work.* Chicago: A. W. Shaw Company, 1926.

In view of the priority of space, interest, data and argument allotted in this volume to the discussion of the community chest movement, which has flourished so widely in the United States during the last decade, there is almost a touch of irony in the foreword contributed by Mortimer Schiff, distinguished philanthropist and banker, when he remarks: "The only point with which I am not fully in accord with the authors is in the emphasis which they place upon the community chest as a plan for the financing of social work and their optimism regarding its development."

The first half of the book is devoted to "underlying principles," a discussion that early eventuates in enthusiastic endorsement of the community chest. While the doubts and questionings expressed in the preface are acknowledged and dealt with, their treatment seems somewhat sketchy and lacking in both depth and breadth, as compared with the vigorous and authoritative presentation of the more obvious and generally considered aspects of the problem. At least, there still remains much room for more penetrating discussion of the principles and policies exemplified in the community chest movement, especially as it affects freedom of leadership, experimentation and minority opinion in dealing with social problems, as well as the problem of maintaining broadly democratic control of community planning and social service.

The second half of the volume, devoted to the technique of organizing and conducting solicitation of financial support for social work agencies, is a mine of valuable information and suggestions, drawn from a rich experience and a wide investigation. It is also refreshingly free from the "go-getter" spirit that may so easily overshadow the main social objectives that underlie such campaigns. The authors show a genuine appreciation of the deeper motives and values that justify and dignify the somewhat spectacular appeals of social work for financial support, and they are deeply interested in the educational and constructive aspects of these campaigns. At the same time they have practical realization of the necessity of building increasing participation and support upon the foundations of interest and understanding that already exist, however unsatisfactory or inadequate those may, for the moment, be.

There is an important phase of social work financing which the authors omitted from consideration, though it would appear to fall within the broad limits of the book's title. It is the relation of governmental to private financing. To those who believe, with this writer, that one of the pressing problems of the present and immediate future in social work is the establishment of right relations and of a sound division of labor and support between public and private agencies, the omission of any discussion of the problem will be a surprise and disappointment. The state and local subsidy system, the so-called "Columbus Plan" of poor relief by which the governmental agency furnished the funds and the private agency dispensed the service, the problems and principles of public supervision of private charitable funds—all these would seem to have a rather direct and important bearing upon the form of organization, the extent and method of solicitation of private contributions, and the accounting of such funds.

On the whole, however, this volume is a welcome and valuable addition to the library of any progressive administrator of a social work enterprise and of any public-spirited citizen who wishes his effort to count most effectively in the advancement of the social program of his community.

KENNETH L. M. PRAY.

ELLINGWOOD, ALBERT R., and COOMBS, WHITNEY. *The Government and Labor.* Pp. xv, 639. Chicago: A. W. Shaw Company, 1926.

This volume is a collection of illustrative material bearing upon the major problems which have grown out of the relations between the government and labor in the United States. It contains the more important statutes, judicial decisions, administrative orders and reports dealing with these problems. It is the conviction of the editors that "the process of learning" can be aided by the use of the inductive methods of the laboratory. They

seek, therefore, in this compilation of original material, "to make it possible for the student to see the mill at work, to sample the grist that enters it and the meal that it produces."

The materials included are arranged under appropriate headings. The basis of governmental regulation, the labor contract, the protection of the laborer against competition, the labor union, the labor conflict, safety and health, hours of labor, wages, unemployment, workmen's compensation, and social insurance are the subjects which engage the attention of the editors. A large portion of the volume is virtually a case book on labor law, since some seventy federal and state judicial decisions are inserted. In view of the important rôle the courts play in government regulation of labor in the United States, it is to be expected that any book of readings in this field must give extensive space to court decisions.

The editors have rendered an inestimable service to teachers and students in compiling this excellent collection. By a careful pruning and condensation of this official material they have made available relatively inaccessible primary sources. Occasionally the editors insert introductory and explanatory statements, although for the most part they allow the official documents to speak for themselves. An especially commendable feature of the text is the inclusion in each section of a list of questions related to the main theme of that section and its ramifications. These questions are illuminating and suggestive, and add appreciably to the merit of the volume. The organization of the entire volume is well balanced. A little more attention might have been given to the decisions and more particularly the working methods of governmental administrative commissions vested with the administration of labor legislation.

It is the conviction of the editors that the student should not have access to the secondary and predigested matter on the subject of the government and labor until he has consulted the original materials. There is room here for an honest difference of opinion. Where the student is not under the guidance of competent instruction, this handicap could at least in part be overcome by the use of the secondary materials. Under any circumstances, it is the opinion of the reviewer that the omission by the editors of references to collateral sources impairs the utility of the volume and detracts somewhat from an otherwise exceptionally creditable compilation.

MARTIN L. FAUST.

SEABURY, WILLIAM MARSTON. *The Public and the Motion Picture Industry.* Pp. xiv, 340. Price, $2.50. New York: The Macmillan Company, 1926.

Mr. Seabury states in his preface that the purpose of *The Public and the Motion Picture* is "to initiate and to render articulate an international movement to fix and establish the status of the motion picture in every nation of the world as a new public utility and to require the industry, without diminishing the popularity of its entertainment, to consecrate its service to the cultivation and preservation of the world's peace and the moral, intellectual and cultural development of all people" (p. x). It is apparently his belief that this purpose can best be achieved through legislation, though he does give slight recognition to the basic economic facts and principles involved in such a fundamental reform.

The layman, unacquainted with the development and methods of the motion picture industry, may obtain from this work an elementary if somewhat biased description of the industry in the United States, Canada and the leading European countries. The Latin-American nations and the Orient are not considered of sufficient importance to merit mention. Mr. Seabury's descriptive analysis is limited by his desire to show the need for a corrective program centered on the present practical monopoly and its alleged attendant evils, which are said to be artistically, morally and economically disadvantageous to all concerned. While there is no doubt a large element of important truth in such a point of view, the facts and opinions cited do little more than establish the serious handicap of those individuals and nations so unfortunate as to be left out of the inner controlling circle. The views and contributions of the "monopolists" who

aided so materially in bringing the industry to its present position should have fair consideration in any calm discussion of the growth difficulties of our industrial infant.

Eighteen specific and a number of general legislative reform measures are suggested, including such proposals as the "declaration of the status of the motion picture as a new public utility" (p. 290), the separation of the functions of production and distribution from that of exhibition (p. 294), the "prohibition of monthly consumption of twenty-five per cent or more of the screen time of any theatre by any producer or distributor of pictures" (p. 297), the "prohibition of any undue or unreasonable increase in the rental of films or the license fees for the exhibition of pictures and the prohibition of any undue or unreasonable increase in admission charges" (p. 303), and the elimination of "block booking," "black lists," quantity rental discounts on unfair terms, and obscene and socially undesirable pictures. Federal control, but not censorship, is advocated in order that the annoyances of various state acts and taxes may be avoided. Similar legislation is recommended to European governments, with the additional recommendation that private international trade alliances would be helpful. Mr. Seabury has evidently given much thought to the legal problems involved, but a great amount of economic and social research is required before his ideas can safely be refuted or accepted.

DONALD YOUNG.

DICE, C. A. *The Stock Market.* Pp. xiv, 667. Chicago: A. W. Shaw Company, 1926.

The stock market, how it operates and how to operate it, has been a popular theme among writers for many years. The mass of material contributed has, however, related mainly (1) to a social justification or condemnation of speculation or (2) to "inside" methods on how to beat the market, and in most instances has been partisan in character. Outstanding exceptions have been: Emery, *Organized Speculation on the Stock and Produce Exchanges of the United States;* Brace, *The Value of Organized Speculation;* Huebner, *The Stock Market;* and Meeker, *The Work of the Stock Exchange.* Professor Dice in *The Stock Market* has added another important exception.

This book accomplishes two things. It gives a detailed description of the organization and technique of stock exchanges and trading. Secondly, it outlines and weighs the relative merits of those factors which one must take into account in order to intelligently speculate in stocks. The descriptive portions include chapters on the growth and organization of stock exchanges, on the nature of stocks, on dealers and brokers of stocks and their work and special chapters on rights, convertibles, puts and calls, and other special phases of stock market organization.

The chapters devoted mainly to developing the factors of intelligent speculation include: "Purchasing on Margin," "The Stop-Loss Order and the Hedge," "Tape Reading and Chart Trading," "Averaging and Pyramiding," "The Technical Position of the Market," "Stock Price Averages," "The Dow Theory," "The Money Market in Relation to the Stock Market," "Forecasting the Major Trends," "Methods of Rating Securities," and "Analysis of Securities."

The author has interwoven the descriptive portions of his work with the analytical. This has apparently been done to make the material more interesting for the general reader. A free use of stock market terminology has also been included for the same reason. These characteristics will doubtless please the tired business man who desires to learn something about the market in which he occasionally places some surplus earnings, but to the careful student or teacher a greater degree of exactness in presentation both from paragraph to paragraph and from chapter to chapter is to be desired. Doubtless to avoid the commonplace, also, the author has devoted a minimum amount of space to the economics of the stock market and to the legal phases of the subject, and in their place has substituted rather frequent references from the *Wall Street Journal.* This will doubtless appeal to the chart

trader but decreases the value of the book as a general text.

G. WRIGHT HOFFMAN.

SCHOLZ, K. W. H., and PATTERSON, S. H. *Economic Problems of Modern Life.* Pp. xii, 615. Price, $4.00. New York: McGraw Hill Company, 1927.

Until recently most books on economics treated entirely too exclusively the old orthodox concepts of the laws of economics. This method naturally allowed of too little attention to the current problems of man in his economic activities. Many of the texts seem to be written primarily for the commendation of the author's contemporaries at the sacrifice of the immature or new student of the subject or of the layman on the street. Too many of the theorists have shown either a woeful lack of knowledge of the possibility or impossibility of the application of their theories, or have failed to appreciate this point.

S. H. Patterson and K. W. H. Scholz in *Economic Problems of Modern Life* have made a very definite and worth-while contribution to the field of economics. They have presented in a concrete, tangible, and at the same time teachable form, our current economic problems.

Experience in teaching such courses as money and banking, finance, merchandising, etc., etc., to upperclassmen leads one to doubt the value the student receives in the prerequisite course in the traditional, abstract, theoretical elementary course in "Principles." Featured as an exercise in mental gymnastics, or as a class-room or living-room discussion this method of treatment doubtless has some interest and benefit for a few. To the majority of undergraduates, however, it neither prepares for future academic work, nor for life.

Economic Problems of Modern Life senses this situation and fills a large gap. The authors have very properly avoided stressing the purely price concept of economics, and stress the importance of man as the chief factor in economic life.

The book is exceedingly extensive as well as intensive. The average college student studying economics for the first time, and using this text only, would be lost in the maze of facts.

A better balance and coherence would be attained by making Parts 3 and 4, Parts 2 and 3, and by placing the present Part 2 (Trusts, etc.) as Part 4. The monetary and financial discussion of Chapters 11 to 21 inclusive should follow Chapter 5. At the same time the problems of monopoly should be more closely connected with the problems of labor and in ustrial unrest.

HORACE R. BARNES.

DAY, EDMUND. *Statistical Analysis.* Pp. xxvii, 459. New York: The Macmillan Company, 1925.

Some indication of the growing interest in statistical procedure is afforded by the constantly increasing volume of textbooks of statistics that come from the publishers. Professor Day, who is dean of the School of Business Administration of the University of Michigan, has given us a volume noteworthy in several respects. He has been convinced that the weak point in most statistical research lies not in the inability to use the various techniques of procedure but in failure to grasp the logic of statistical analysis. Therefore his book is carefully designed to give the student not only a thoroughgoing training in the elementary techniques but also in the much needed orientation in the general limitations and uses of quantitative analysis. Day indicates that there has been too wide a separation of graphic methods of presentation and the material to be presented, in most textbooks. He has explained graphics wherever the subject arose. The book is loaded with charts and graphs and these add greatly to the interest of the student as he makes his way along the painful path to statistical knowledge.

The mechanical make-up of the book is pleasing. The heavy gloss paper is durably and flexibly bound and the typography clear. There is a brief index and bibliography. Several appendices of handy information for the student include: Table of Logarithms, Table of Squares, etc. (1-1000), Relationship between r and rho.

HUGH CARTER.

SLOAN, L. H. *Security Speculation*. Pp. 280. Price, $3.50. New York: Harper and Brothers, 1926.

Mr. Sloan, who is associated with the Standard Statistics Company, Inc., of New York, presents in this book a statistical study of the relative merits of three methods of speculation. Eighteen representative common and fourteen preferred stocks are used and tested over the twelve-year period January 1, 1914, to January 1, 1926.

Under the first method (Test I) the imaginary speculator places a fixed amount of money in stocks on the first of January each year and on January 1, 1926, sells out his holdings. His total profit is then calculated, which includes both dividends and capital gains or losses, and reduced to an annual average percentage gain or loss. Under the second method (Test II) the speculator follows the long-pull idea and invests a fixed sum at the beginning of the eleven-year period and sells at the end of the period, his profit as above being reduced to a percentage basis.

Under the third method (Test III) the speculator, observing the fact that stock prices are subject to large cyclical swings, attempts to so time his purchases and sales that he may benefit from each of the upward movements. In this he is successful enough to catch approximately two-thirds of each upward swing. During the downward movement, he puts his money in the bank and with the next upward swing reinvests his enlarged capital fund, selling out finally on January 1, 1926, his total profit being reduced as above to a percentage basis.

Mr. Sloan concludes that the last of the above three methods offers greater possibilities for profit than the first two methods because definite account is taken of cyclical stock price movements. The time of purchase and sale is the essence of the problem. "It is the exceptional security which returns an adequate profit if it is bought at the wrong time; likewise, it is the exceptional security that fails to return an adequate profit if it is bought at the right time" (p. 133).

Three points in criticism of Mr. Sloan's methods should be mentioned. He has chosen a period of time—January 1, 1914–January 1, 1926—which begins with a nadir in the stock price cycle and ends with a point which, if not a peak, certainly is far above the price trend during this period. Under both Test I and Test III because of successive additions of capital investment, the latter part of the period is heavily weighted compared with the first part. But the weighting is not the same for Test I as for Test III and with no weighting at all for Test II. How much a correction for the above two points would alter the conclusions drawn is hard to estimate.

Finally Mr. Sloan calculates the profits of the third method (Test III) by allowing the speculator to profit by an average of two-thirds of each upward price swing. Is this too much of a compliment to the intelligence of the average speculator? At one point the author warns the reader that his results "do not purport to prove that catching two-thirds of *any* long up-swing is average performance" (p. 126). But at another point he states: "If he had been an intelligent and well-informed operator, rather than an imaginary one whose dealings were directed by purely mechanical methods, he might have done considerably better than this [referring to obtaining two-thirds of the average swing]. The point is that, in using this particular mechanical device for establishing theoretical buying and selling prices, we do not feel that we are giving to our theoretical speculator an unfair advantage. Indeed the method employed tends to underplay his possible profits, rather than exaggerate them" (p. 39). The part in brackets was inserted by the reviewer. Had a more conservative fraction than the two-thirds been used and for either three or four complete cycles instead of three and one-half cycles, the results would have been considerably different.

The author has an easy style, approaches his subject without apparent bias and as a result has prepared an interesting and stimulating monograph.

G. WRIGHT HOFFMAN.

MACNAIR, H. F. *China's International Relations and Other Essays*. Pp. vii, 326. Price: Trade, $2.00; School Edition, $1.20. Shanghai: The Commercial Press, 1926.

Seldom is it possible to secure so authoritative and sympathetic a statement of

contemporary international and missionary problems confronting China as is found in this volume. The author is recognized in the country of which he writes as an analytical student of Chinese history and politics, and enjoys the reputation of being fair and constructive in his criticisms of Chinese and Westerners alike.

The essay from which the title of the volume is derived was originally prepared for and published by the North China Branch of the Royal Asiatic Society in 1925. A remarkably concise account is given of the periods of intercourse between China and the West, with illuminating quotations from Chinese documents showing the attitude of superiority assumed by the Sun of Heaven before the time of European military expeditions in China commencing about the middle of the nineteenth century. Another essay deals with the ignorance of Americans regarding Oriental psychology and customs, summing up the matter with the comment: "It stands to reason that the understanding of the problems of the Pacific and the Far East must not be a one-sided one. It is every whit as imperative that America shall come to understand and appreciate the culture of the East as that she shall develop friendly political and commercial relations with the nations of Asia —in fact, she cannot hope permanently to accomplish the latter unless she does the former concurrently."

A third chapter or essay is a contribution of much value to those who would inquire why Japan was able in so short a time to overcome obstacles imposed from without similar in nature to those which China today is contesting. Having studied with care the methods by which European states advanced their material interests, Japan resolved to progress by the same processes. In the words of Professor MacNair: "A careful study of Japan's dealings with Korea and China in particular, and with other nations in general, cannot fail to impress one with the aptness of Japan as a student in learning and applying the worst tricks of European diplomacy in its modern foreign relations, as well as of assimilating some of the finer parts of Western culture in certain sections of the country."

A considerable portion of the book is devoted to a survey of the status of Christianity in China. The account of the history of Christianity in this particular field of missionary endeavor first was read as a paper before the Shanghai Missionary Association, November 3, 1925. Each of four periods of Christian activities, viz., the Assyrian or Nestorian, the Catholic Franciscan and Neo-Assyrian, the Catholic Jesuit, and the modern Catholic and Protestant, is described in sufficient detail to give the reader a clear impression of the nature of the work and the difficulties to be overcome. Among the most valuable features of this particular essay are the statements of reasons for the failure of Christianity to survive in each of the three periods preceding the present one, and suggestions as to the probable and possible outcome in the immediate future. The pages of the article on missionary ethics will be read with great interest by all who are associated with or interested in the evangelical movement in China, touching upon as it does some outstanding problems which must be met before the Christian cause can attain complete success. Seldom is the issue so squarely presented, so that all may be informed upon the facts of the situation.

W. LEON GODSHALL.

ZIMMERN ALFRED. *The Third British Empire.* Pp. 148. Price, $2.00. New York: Oxford University Press, 1926.

The Third British Empire is that which has existed since 1918; the first was overthrown in 1776, and the second culminated in the World War. In a series of five lectures originally delivered at Columbia University in 1925, and brought up to date for publication in the summer of 1926, Mr. Zimmern has outlined the internal and external situation of this Third Empire.

When other empires—for example, the Russian Empire or the Austro-Hungarian Monarchy—fell under the blows of the war, the British Empire continued, although in a changed condition. Why? In spite of centrifugal forces, the British spirit of liberty vitalized the old Empire into a Commonwealth of Nations. How has it survived? In what form? As a British

Entente within a larger League of Nations. What must it do to justify its survival in an age which seems destined to dissolve empires? By pioneering in the field of war-prevention: in inter-racial relations, in economic relations, in the problem of nationality. These three questions are set by the author in the opening paragraphs, and answered as has been briefly indicated.

Mr. Zimmern does not feel that the Empire is in all cases following the path likely to lead to the best results, either for itself, or for the world. However, at times, in commenting on the larger implications of a given situation, he seems to fail to recognize serious blunders in empire policy, such as have arisen in India and Egypt. Altogether, the book is a stimulating résumé of empire problems from a British viewpoint, broad in interpretation, and optimistic in outlook.

W. M. BLAISDELL.

HEALY, WILLIAM, M.D., and BRONNER, AUGUSTA F., PH.D. *Delinquents and Criminals.* Pp. xiii, 317. Price, $3.50. New York: The Macmillan Company, 1926.

This volume is a pioneer in its field. It is a scientific study showing in what measure we have been successful in the handling of juvenile delinquents. Four thousand actual cases furnish the details for definite and remarkable conclusions concerning this vital question of national importance.

The work presents several outstanding and unusual features. A new aspect of the situation is shown by a comparison of two thousand cases of juvenile delinquency in Boston with two thousand similar cases in Chicago showing methods of treatment and degree of success or failure in results of both. All cases were studied first during juvenile court age and follow-up work was completed only after the child was well over juvenile court age.

The comparison of the work in the two cities shows the failure of both to meet their problem. We, therefore, readily acknowledge that the same failure exists in all other American cities with perhaps the exception of those in which special work has been done: Example (Denver), as the same type of homes, sentences and instruction are nation-wide and a crime that will send a boy to the House of Correction in Chicago will demand the same punishment in New York or San Francisco.

A large number of charts found throughout the book and in the appendix give statistics on all phases of the work such as percentage of success and failure in committed and uncommitted cases, health, mentality, condition of homes and community. Other charts present age, weight correlation, race, type of crime and type of correction tried.

The book is based on fact and the facts are compiled in these charts which are made quite clear by the accompanying explanation.

The reports are based on the individual case study method. An individual study has been made of each case cited and the results show clearly the futility of the use of any other method in the study of crime if success is to follow the treatment. It shows the utter hopelessness of using the same methods of treatment, year after year, and using the methods in relation to the crime committed rather than adjusting the remedy to the individual personality.

No person can read the book without a realization of the vastness of the work and the undeniable effort to present facts as they really are. It reveals that between forty and fifty per cent of the cases treated in Boston and Chicago are unsuccessful. This undoubtedly condemns the present system and confronts the novice with the seriousness of the delinquency problem and the need of radical changes in the method of dealing with the juvenile offender. It should also be placed in the hands of all people dealing with delinquents, as it proves the absolute need of treatment that meets the different needs of the individual and of research that will furnish a vast store of professional literature of the nature of this work.

The conclusions of the authors are quite worth while in themselves as they are not only based on the cases within the covers of the book but have grown out of the extensive experience in the field of Drs. Healy and Bronner.

G. BAKER THOMPSON.

HADFIELD, SIR ROBERT A. *Metallurgy and Its Influence on Modern Progress, with a Survey of Education and Research.* D. Van Nostrand Co., 1926.

The author of this book has been an outstanding pioneer in the discovery and manufacture of steel alloys. This volume he apparently wrote as a diversion from, and summation of, particularly his personal contributions to their development.

This book deals chiefly with the historical development of alloy steels (1882–1926) and appends a sketchy survey of the facilities for metallurgical research, particularly in Great Britain. There is very little concerning the application of alloy steels in modern industry, and no statistics to indicate precisely their increasing importance. The volume contains some introductory chapters on the earlier history of science and of metallurgy in particular, but in this field the author has only the very slightest scholarly acquaintance. There is a lengthy chapter on "Fuel Economy," but this is a study of a very narrow part of this tremendously important aspect of industrial and general cultural history—reviewing almost solely fuel economy in the production of iron and steel, of especial interest to the author in his capacity of manufacturer of those products.

The title is, therefore, seriously misleading as to the scope of the book. It serves chiefly to re-suggest the need for truly scientific study not only of the history of metallurgy—which is here and there being worked out—but of all the essential aspects of the influence of evolving metallurgy on the development of human culture. On this subject there is no general treatise of note, and but a few scattered papers.[1]

WILLIAM CHRISTIE MACLEOD.

AGG, THOMAS R., and BRINDLEY, JOHN E. *Highway Administration and Finance.* Pp. x, 382. Price, $5.00. New York: McGraw-Hill, 1926.

Professor Agg, of the engineering faculty, and Professor Brindley, professor of economics at Iowa State University, have collaborated in bringing out a text dealing with the legislative enactments required to provide a stable basis for highway developments, with financing plans for highway systems, and with the organization and functions of state or municipal highway departments.

The work is based very largely upon well-selected material from current literature upon the subject of highway construction, finance and regulation, but it is well salted with observations, comments and criticisms by the authors. The text is liberally sprinkled with excellent suggestions for collateral reading so that the reader is given a taste of the problem in this treatise and expert direction for a broader and deeper study of the subject through the footnotes and references.

G. L. WILSON.

[1] For example: Eckel, *Coal, Iron and War,* 1922; W. Hough, *Man and Metals,* Proc. Wash. Acad. of Sciences, V. 2, 1916; MacLeod, *Fuel in Early Civilization,* Amer. Anthrop., 1925; and discussions on iron culture in Asia in Bishop's and Laufer's Studies of Chinese and Japanese culture origins.

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ARE THE FILIPINOS READY FOR INDEPENDENCE?

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FOREWORD

THERE is no problem confronting the American people which will require broader statesmanship than the adjustment of our future relations with the Philippine Islands. Earnest students of the subject have arrived at widely divergent conclusions, and it was because of this fact that the Academy decided to devote one of its sessions to a discussion of the subject.

The addresses delivered at the Academy session proved to be so illuminating that it was decided to publish them in a special volume which we have great pleasure in sending to our members.

L. S. ROWE
President

Are the Filipinos Ready for Independence?

By Honorable Carmi A. Thompson
Special Representative of the President

WHEN Marco Polo returned to Europe after an absence of seventeen years spent in China, Japan, and the Philippine Islands, he was thrown into jail for his supposed lies concerning these faraway countries which he described as Cipango, Cathay, and the Islands. For a century or more after his death he was regarded as Ananias' superior; but the travels of later explorers verified nearly every statement he made concerning these so-called mythical lands.

I have recently spent some time, at the direction of President Coolidge, in the Islands, named by the Spaniards "The Philippine Archipelago," in honor of Philip the Second of Spain.

I refer to the experience of Marco Polo to justify a request for leniency when I introduce my subject, with a little incident which occurred about the time my work was concluded in the Islands.

My party, including a number of newspaper correspondents, was at Baguio, a mountain resort north of Manila.

One morning a newspaper correspondent, my executive secretary, Mr. Jappe, and I visited the Benguet Gold Mine, near Baguio. Dressed in woolen clothes, quite a contrast to the customary whites we had worn for three months, we proceeded to the head of the trail leading to the gold mine. The panorama was the most beautiful I had ever seen. I could hardly believe my own eyes. I asked the correspondent what he saw. We were standing at the very edge of a dense pine forest. Looking down the trail he began to enumerate the interesting features on the landscape—said he: "I see a splendid grove of tree ferns, and just beyond a clump of coconut palms in full bearing, and yet a little farther to the left a native boy gathering bananas, and still farther the entrance to one of the richest gold mines in the world. I am glad I have no assignment to write this description for my paper. My managing editor would conclude that I had succumbed to the subtle influence of the Orient."

Nevertheless, this picture was before our eyes. The Benguet mine is 3000 feet below the Baguio pines, and in that fall is the entire climatic condition from the temperate zone to the torrid zone. Unlike poor old Marco Polo, I can prove my story by proper and acceptable evidence.

The Climate, Geography, and Population of the Philippines

This story, to a certain extent, describes the climatic conditions in most of the Philippine Islands. The Islands are volcanic in character, and are usually mountainous in the center with great fertile, tropical, coastal plains lying between the seashore and mountains. The mountains furnish the conditions which produce an abundance of rainfall, the water supply for irrigation and for power, and the cooling land breezes tempering the tropical heat of the plains. Fertile, well-watered, twelve months of growing vegetation, its mountains laden with minerals and metals ready for the use of man if he will but take them. Is it any wonder that the Philippine Archipelago has

been known for a century or more as the Pearls of the Orient?

You will recall that the Philippine Islands are about 300 miles southeast of Asia; that from the northernmost island of the Philippines the southernmost island of Japan may be seen upon a clear day, and that the southernmost island of the Philippine Archipelago is practically contiguous to British Borneo. You will also recall that beginning with our Aleutian Islands there is a continuous chain of islands facing the entire continent of Asia and extending south of it. These Islands are under the control of America, Japan and Great Britain. Visualizing this chain of islands, you will readily see that they form an outpost for the continent of Asia; that the change in ownership or control of any of them might readily affect the commercial relations of the entire world with China and the Asiatic Continent generally.

The Philippine Archipelago is composed of 7083 islands of which 2441 are large enough to carry names. The total land area is 115,000 square miles. Notwithstanding the great number of islands, ninety-five per cent of this territory is contained in the eleven largest islands.

In order that you may visualize clearly the land area of the Philippine Islands, I will tell you that the Island of Luzon, upon which Manila, the capital, is located, is about the size of Ohio, and the Island of Mindanao is about the size of Indiana; and as a group they will compare fairly well with the total landed area of the New England States plus the states of New York, New Jersey, Delaware, and Maryland. Another comparison is interesting—the entire Kingdom of Japan, outside of the little Island of Formosa, contains about 155,000 square miles of territory, of which a little more than one-third is tillable. In other words, the flowery kingdom has but 40,000 square miles of tillable land, whereas of the Philippine Islands, with their 115,000 square miles, more than half is available for the raising of ordinary tropical crops, and ninety-five per cent of the entire area is available for agriculture or forestry. Of this vast area, but fifteen per cent is now being utilized. The other eighty-five per cent is public domain and is not contributing to the development and prosperity of the human race.

The population of the Philippines is about 12,000,000. Of this number about 11,000,000 are so-called Christian Filipinos, subscribing almost unanimously to the doctrines of the Catholic faith. Of the other 1,000,000, about 400,000 are Moros, who subscribe to the doctrines of Mohammed, and the remainder are so-called forest dwellers or hill people who are pagans.

No discussion of the Filipino people would be complete without a reference to the Moros, a very picturesque and interesting people. Unconquered by the Spaniards or by the Christian Filipinos, they surrendered to the United States Army because they thought they had an understanding that the American flag would govern and protect them from the Filipino rule forever.

About twenty years ago a musical comedy called "The Sultan of Sulu," had an unusual run in this country. Most people then and since have believed the Sultan to be a myth. I am here to tell he is not. I have seen him, indeed I spent one most enjoyable day in his company. He reminds you very much of the Ancient Moor as described by Washington Irving in his "Fall of Granada." He is interested in education and is a good business man. Of a swarthy complexion, he carries well his sixty-two years. By his treaty with the United States he gave up all tem-

poral power, but in spiritual matters he is the Moro head of the Mohammedan church in the Sulu Archipelago, and it is not unusual to see the Moros falling to their knees for the opportunity of kissing his hand.

I am told that the Mohammedan religion does not permit a man to have more than four wives at a time, but this grand old Sultan has had, I am told, as many as fifteen wives at one time. I met his favorite wife at a dinner the Sultan gave for our party. I met his brother, who, because the Sultan has no direct heirs, is next in line for the throne. The future chieftain has taken to himself eight wives.

During my visit with the Sultan he took me to the new palace which he is now constructing and of which he is very proud. While thoroughly tropical in its architecture, it will stand out as one of the most beautiful homes in the Philippine Islands.

The town and province of Cotabato in Mindanao is another Moro stronghold. To reach Cotabato we sailed ten miles up Cotabato River. It is known as the Alligator River. Think of the most tropical river picture you have ever seen and you will have a picture approaching to some degree the tropical beauties of this stream.

When we approached the mouth of the river we were met by hundreds of fishing crafts known as "vintas," all decorated in Moro colors, streaming with palm leaves, tropical flowers, fruits and vines, manned by Moros in their picturesque costumes and led by scores of sonorous tom-toms beaten by their most beautiful girls. When we approached the dock we were met first by a datu or headman, his teeth blackened, for as you know they chew betel nut, garbed in a pair of tight-fitting black silk trousers, a very orange silk shirt, but bareheaded and barefoot. In place of buttons in the front of his shirt, there were five-dollar gold pieces. He wore a belt of twenty-dollar gold pieces, and there was a string of ten-dollar gold pieces from his hips down the side seam of his trousers to his feet. He wore five-dollar gold pieces as shoulder ornaments. It is a custom among the Moros to gather American gold money and use it for decoration; but this was the most bedecked Moro I have seen. He wore by his side a weird kris. A kris is a wicked sword used by the Moros. This was also decorated with American gold money. A member of our party counted more than one thousand dollars in gold coin upon this proud datu. Next to him came datu Piang, a patriarch more than eighty years old, considered to be the richest man among the Moros, although born a slave. He wore a highly colored turban, but was barefoot. Riches, however, with the Moro are land, wives and servants. Piang has had thirty-six wives and one hundred and fourteen children, and servants without number. I may stop here to say that later in the day old datu Piang took his kris from his side and handed it to me with its sheath and belt, saying that during his lifetime no one had ever been able to take it away from him; that he was old and he wanted to give it to me as a souvenir of my visit, and that he would never put on again the emblem of war.

Then came the Sultan of Cotabato. He appeared with two or three servants carrying queer shaped, very gorgeous parasols above his head; another one just behind extending the ever present betel-nut box, and one just in front of him carrying a cuspidor, and in the place of outriders there marched a few paces ahead of the Sultan two men with great swords of state. He, like datu Piang, wore no shoes. Everything had been wrought with great care and without regard to expense, except the

cuspidor, but on account of constant change, I presume, it was fashioned from a Standard Oil can, which device was filled with moss and herbs, so that the artistic eye of the Sultan might not be abused, or his delicate olfactory nerve be offended.

With the exception of the intermingling of Spaniards, Chinese and other people who have settled among them, the Filipinos are a pure Malay stock.

Three-fourths of my time in the Philippines was spent among the Christian Filipinos. I landed in Manila on July 9th. My party included Mrs. Thompson, my private secretary, Miss Jones, and my executive secretary, Mr. Jappe, as well as representatives of leading metropolitan dailies and the large news services of the country. I remained in the islands three months and during my stay I visited forty-one of the forty-eight provinces. From the time we left Cleveland until we returned we traveled over 40,000 miles.

THE LANGUAGE OF THE ISLANDS

Concerning the origin of the Filipinos it is known only that they migrated many hundreds of years ago from the islands farther south; that they are an off-shoot from the Malay race which inhabits that part of the world. A few settled on each of the various larger islands of the Philippine group and remained in seclusion there for many years. While they probably started with a common language their isolation on the various islands, or sometimes on the same island but separated by mountain ranges, caused each group to develop its own dialect. There are now eighty-seven dialects and eight distinct languages spoken in the Islands. The eight languages are probably as different, as for illustration, the German and Italian languages. In other words, the members of one group have no way of communicating with the members of another group, unless it is done through English or Spanish. Only the educated and well-to-do know Spanish, and they are the small minority. A large number of the younger element know English. The English language is taught in the public schools. If we retain our influence in the Islands for another twenty-five years, practically everyone will be able to converse in English.

ECONOMIC AND POLITICAL TENDENCIES

The average mentality of the Christian Filipino is high. Physically small as compared with the races of Western Europe he compares well with the Oriental races. They are an affable and generous people. They love music and outdoor sports. They are quick to learn and adapt themselves readily to the mechanical trades. Their thirst for knowledge leads them to colleges in all parts of the world and fills their school-houses beyond their capacity with the younger people. They are very hospitable. Their custom requires you to sit at their table if you would be their friend. This custom was carried to such a degree that on one occasion I was compelled to partake of six banquets, of from ten to twelve courses each, in one afternoon and evening.

On another occasion, on our return from the 7500 mile trip around the Southern Islands, my party was stranded in a small fishing village because the ocean was so rough that our little boat could not land. We were compelled to remain over night. Two of the leading families took us in. We were treated to a tasty dinner and comfortable beds for the night and breakfast the next morning. We learned later that both families gave up their entire house to

us and slept in their barns. We found that same hospitality whether we were with Senate President Quezon in Manila, Senator Oamena in Cebu, General Aguinaldo in Cavite, or the common people in the provinces.

The Filipino has no inclination toward business or the practical development of the great natural resources. Those who are educated look to the profession of law or medicine, or toward politics for a livelihood, and even those who look to the legal or medical profession, expect in the end to draw their pay from the government. In fact, with the Filipino leader, everything begins with politics and ends with politics.

I was not in Manila long until I learned that the fundamental problem of the Philippine Islands was the political problem; that no economic development could be started until the political status of the Islands was settled finally or for a long time to come. Under the present conditions of political uncertainty outside capital will not invest in the Islands. As a matter of fact, the Filipino leaders are discouraging the admission of capital for investment, fearing it would lead to economic exploitation and retard the day for independence.

I found business at a standstill; time that should have been or could have been consumed in the development of the Islands was being used to discuss the independence question. Filipino labor, which to my mind is the most efficient in the Far East, is emigrating to Hawaii and the United States.

All political activities in the Islands radiate around the independence question. Americans who believe that the independence cry comes from the so-called "Politicos" alone, are mistaken. There are two well-defined political parties in the Philippines, but they differ only on internal matters. Both have the same views on independence. All Filipinos who are interested in public affairs are openly for independence, and no one can be elected to public office unless he advocates independence. I believe that practically the entire voting population is for independence. Of course only about forty per cent of the adult male inhabitants have qualified as voters under the Organic Law, which provides for literacy, property and other qualifications. Women do not possess the franchise. How the non-voting population stands on this question can hardly be ascertained, but it is safe to say that the independence movement is growing all the time. Every child in the public schools is taught to cry for independence. The American teachers, sent to the Islands a quarter of a century ago, started the movement and now the Filipino teachers are continuing the work. Some of the most violent advocates of "the independence movement" are Filipino educators who have been trained in American colleges. Most Filipinos do not realize the responsibilities that go with independence. Their leaders never discuss this phase of the question.

COMPLETE INDEPENDENCE IMPOSSIBLE

I believe that complete independence is impossible now, and for a long time to come. As I said in my report, I believe the Philippines lack the financial resources necessary to maintain an independent government. The Islands are too poor to carry on the necessary housekeeping duties of a nation, let alone the expenses of an army, navy, diplomatic corps, and consular service. Practically all the bonded indebtedness of the Philippines is held by citizens of the United States. If the payment of these bonds were made a prerequisite to independence, the Philippine government would have

no means with which to redeem them. Then they lack a common language, and for other reasons the Filipinos do not have the homogeneity and solidarity which are the requirements of a strong nation.

A bitter religious feud between the Christian Filipinos and the Mohammedan Moros might accentuate the danger of a civil war should independence be granted at this time. From the standpoint of American commercial interests in the Far East, it would be unwise to relinquish control of the Islands at the present time. We need the Philippines as a commercial base, and their retention will otherwise be of great benefit to our Far Eastern situation. Independence would end the free trade relationship between the United States and the Philippines. This would bring about economic disaster for the Islands. Also, the abandonment of the Philippines at this time might complicate international relations in the Orient.

The independence propaganda might give one the impression that the Filipinos will not be satisfied with anything less than complete, absolute, and immediate independence. During my stay in the Islands, I sought every opportunity to obtain the opinions of Filipino political and business leaders, and to my mind what they really hope for is an early settlement of their relations with the United States on a basis which would give them complete autonomy in internal affairs, but with the United States directing all foreign affairs.

The other phase of the political problem is the breach between the Governor-General and the Legislature. This breach has reached the stage where one branch of the government does not seem to have confidence in the other, and vice versa. Consequently no constructive legislation is possible under this condition. The Governor-General, being a distinguished soldier, naturally has confidence in, and has relied to a great extent upon, his military associates, who have been styled in the Islands as his "Cavalry Cabinet." The members of this cabinet, like the Governor-General himself, have splendid military records, and are gentlemen of the highest type. It is impossible, however, to overlook the criticism that they are unfit for the tasks assigned them, and that, in some cases, they have caused needless friction by tactless methods in their dealings with the Filipino leaders.

The Filipino leaders complain that the Governor-General has virtually destroyed the autonomy, which they acquired under the former Governor-General, and further allege that the Governor-General has actually, although not nominally, established himself as a military dictator, and that he has interfered in local matters. The leaders are continually telling their people that this group of army officers, whose advice, they say, the Governor-General takes almost exclusively, really governs the Islands. This is an unfortunate condition, for it gives the leaders an effective argument. On the other hand Governor-General Wood, when he assumed office, took over the administration of a government, which according to the Wood-Forbes report, had been run in a reckless manner. Business administration was said to be relatively inefficient, and in some branches corrupt. The financial position of the government was almost hopeless. Under Governor-General Wood's administration, the peso returned to par; the Philippino National Bank, which was practically insolvent, was kept open; and the administration of government departments was greatly improved. At the same time, the Gov-

ernor-General sought to conduct the government with a strict interpretation of the Organic Act. In so doing, he resumed and exercised many executive powers which his predecessor in office had virtually abandoned.

I am glad to say that I found no evidence of any anti-Americanism, which would necessitate military control. The Filipinos are grateful to the American people for the progress made by them during American control.

THE DUTY OF THE UNITED STATES

The United States has a duty to perform towards the Filipino people. We must not abandon these islands to the risk of an independent existence, without reasonable preparation to meet the economic competition or the aggression of the stronger nations. We must not drop the tasks which we assumed a quarter of a century ago until we have satisfied ourselves that the Filipinos are prepared for complete self-government, but at the same time we should not take away from the Philippine people their aspiration to govern themselves whenever they are able to stand alone as an independent people.

While we are preparing the Filipinos for self-government, we should not reduce the internal autonomy which they have been granted, unless their own conduct should make this necessary.

Also while we are preparing them for self-government, we should keep in mind that this entails making the Philippines a going concern in a financial sense. Today they lack the financial resources necessary to maintain an independent government. The revenue derived from taxes in the Islands amounted in 1925 to only $44,000,000. This would not be enough to support them, if in addition to carrying on their necessary internal activities, they had to pay for many services which our War, Navy, State, and other departments now render without charge to the Philippine people.

With the proper economic and political development, the Philippines would enjoy an era of prosperity such as has never been known in the world.

RECOMMENDATIONS AS TO POLITICAL CHANGES

The political changes which I believe to be necessary, are as follows:

Steps should be taken at once to reestablish cooperation between the executive and legislative branches of the government. The Governor-General should be provided with the necessary civil advisors and not be required to choose such advisers from the United States army.

The administration of the Philippines, together with our other overseas possessions should be transferred to an independent establishment reporting directly to the President, or to a special insular bureau in one of the civil departments.

The Federal Reserve System and the Federal Land Bank should be extended to the Islands.

During the last two years we have heard a great deal about the British rubber monopoly. I saw rubber raised on the Island of Basilan, where experts said conditions are more favorable than in the Straits settlements.

With the introduction of capital and the settling of the political questions, the Philippines can raise sufficient rubber, camphor, and coffee to break the monopolies in these necessary commodities which foreign nations now maintain to the disadvantage of the Americans and also of the Philippine people.

I am firmly convinced that we can do most good for ourselves in the Philippines by helping the Filipinos to make the most of their great opportunities.

We must approach all Philippine problems with sincerity, sympathy, understanding and friendship. The Filipinos, as a people, are worthy of our confidence and our assistance.

There is much to be done to remove the obstacles to Philippine development that have been raised by misunderstanding and prejudice.

If my efforts contribute anything toward clearing these obstacles, and bringing about a better relationship between the American and the Philippine peoples, I shall feel well repaid, for then I shall know that I have rendered a real service, not only to the one hundred and ten million people of America, but to twelve million more in these far-off islands who need all the help American statesmanship and American business can give them. In meeting these Philippine problems, I am sure, America will measure up to our finest national traditions.

The Philippine Problem

By Pedro Guevara

Resident Commissioner from the Philippines, Congress of the United States

SCARCELY a month has elapsed since the transmission to Congress of the report of Colonel Thompson, who was sent last year as the special envoy of President Coolidge to the Philippine Islands. As might normally be expected, in view of the conflict of interests affected by any proposed solution of the Philippine problem, this report has been the subject of varying comment. Honest statesmanship, however, does not stop at selfish consideration; it strives to solve the problem presented in a judicial manner and with a view to the best interests of all concerned. The friendly spirit apparent throughout the report is most commendable, and I am very glad to have this opportunity of congratulating Colonel Thompson for most successfully fulfilling the delicate task entrusted to him by the President.

The Political Problem Fundamentals

I absolutely agree with Colonel Thompson that "the political problem is the fundamental problem in the Philippines." The solution of this proposition will at the same time resolve the equally important question of the economic development of the Islands. These problems are inseparable; and all who are sincerely interested in the economic advancement of the Philippines must seek a satisfactory solution of their political status. Thus the question is immediately presented as to what course shall be pursued to effect a solution of the political problem in the Islands.

The mere statement of this question will quite naturally give rise to varying statements of opinion. Men of vision, however, will appreciate that it is never possible for everyone to be satisfied, and that in all human transactions the spirit of mutual concession is essential.

In my opinion there are but two possible alternatives for the United States with regard to the present situation. First, the granting of immediate independence to the Philippines in accordance with the previous promise of this country; second, home rule for the Philippines. This alternative course of action is suggested without in the slightest degree admitting that independence should not be immediately given, but solely because under present conditions immediate independence appears hopeless.

The Jones Law

Passing for the moment any discussion of the arguments offered against the present fulfillment of the pledge of the United States to grant the Filipinos their immediate independence, I desire to call your attention to the preamble of the Jones Law, which reads as follows:

> Whereas it was never the intention of the people of the United States in the incipiency of the War with Spain to make it a war of conquest or for territorial aggrandizement; and
>
> Whereas it is, as it has always been, the purpose of the people of the United States to withdraw their sovereignty over the Philippine Islands and to recognize their independence as soon as a stable government can be established therein; and
>
> Whereas for the speedy accomplishment

of such purpose it is desirable to place in the hands of the people of the Philippines as large a control of their domestic affairs as can be given them without, in the meantime, impairing the exercise of the rights of sovereignty by the people of the United States, in order that, by the use and exercise of popular franchise and governmental powers, they may be the better prepared to fully assume the responsibilities and enjoy all the privileges of complete independence.

When the Congress of the United States passed this law in 1916, it had unquestionably considered all the arguments which are today being advanced against the granting of independence to the Filipino people. An extensive and exhaustive debate on the preamble of the Jones Law took place on the floor of the House of Representatives and of the Senate, and by majority vote of both Houses the American people were pledged to the granting of independence to the Philippine Islands "as soon as a stable government can be established therein." But one test, the establishment of a stable government in the Islands, was designated as the prerequisite to the granting of independence. A stable government, in accordance with the American conception of the phrase, means a government which is capable of maintaining order among the people subject to its rule, and which is further capable of observing and fulfilling its international obligations. Both of these tests have unquestionably been met by the Philippine Islands since the enactment of the Jones Law. The Islands owe nothing to any foreign power; and at this time, when the question of international obligations is so much a matter of discussion, it is worthy of note that the Philippine government has always discharged at maturity its obligations to the United States as to its bonds issued and sold in this country.

APPARENT DIFFICULTIES EASILY OVERCOME

The Philippines possess sufficient financial resources to enable them to start an independent national existence. When once the political status of the Islands has been settled the natural resources of the country and the business energy of its people will unquestionably be developed. New markets will be opened and trade and commercial intercourse with other nations will increase. Under existing conditions there can be no hope for economic progress, and the present industrial stagnation must become increasingly acute. Undoubtedly the Philippines would, on the granting of independence, be confronted with a difficult financial problem; but in this respect the new government would be obliged to meet no greater difficulties than those encountered by other nations in the early stages of their development.

It has been frequently stated that the lack of a common language forms a barrier to the granting of independence. In reply to this I would say that the Filipinos can communicate with each other freely, not only through their native dialects but also through the medium of the English and Spanish languages. Three hundred years have elapsed since they were brought in contact with European civilization, and at no time have they experienced any difficulty in communicating with each other. When the Spaniards first took possession of the Islands they had no knowledge of the native dialect; yet they were able to establish and maintain a substantial form of government in the Philippines. The American people were likewise unfamiliar with the local dialects, but showed a remarkable capacity for instituting and maintaining a stable government in the Islands.

The suggestion that independence would lead to civil warfare, instigated by the leaders of different language groups, is ill-founded. The common interests of the people would make this impossible. In the Philippine Legislature, where different regions are represented, the division of membership is not founded upon regional language, but upon political belief. There are two political parties in the Islands, each of which has in its membership men from regions where different dialects are spoken. Both in the legislature and in political organizations sectional interests are absolutely unknown. The aspiration for independence is national in scope and is not limited to any particular region. If the people of the Islands were given the opportunity to express themselves upon this question by a plebiscite, the vote would be practically unanimous. Notwithstanding oft-repeated assertions to the contrary, there exists a very definite public opinion in the Philippines. It is impossible for anyone to be elected to public office who does not subscribe absolutely and unqualifiedly to the cause of independence. There is no oligarchy and there never will be. Public opinion in the Philippines is very sensitive. Senators, representatives, governors, and mayors, who are all elected by popular vote, are very seldom re-elected. They must have rendered a distinguished public service to be worthy of re-election.

Much has been said of the antagonism which it is assumed exists between the Filipinos of Mohammedan and Christian beliefs. It has even been stated that those adhering to these differing religious faiths do not belong to the same race, although this is in direct contradiction to the statements of noted historians both past and present. During the administration of Governor General Harrison, a most friendly and brotherly relationship existed between Mohammedans and Christians in the Islands, and nothing has occurred since that time to cause any change in this feeling. In proof of my assertion to this effect, I am prepared to produce at any time authentic documents signed by prominent Mohammedans in the Islands which I have in my possession. The best test of the common aspiration and sentiment of the Filipinos of both religions would be a plebiscite, but this has been denied us.

MINOR CONTROVERSIAL QUESTIONS SHOULD BE ELIMINATED

In attempting to arrive at a solution of the Philippine problem it is essential that minor controversial questions be eliminated. The interests of both Americans and Filipinos should be, and in fact are, in unison. The Filipino people have no control as to the determination of their status; the United States is the sole arbiter as to the fulfillment of its promise of freedom to the Islands. Hence, I shall not attempt to discuss the international aspect of the Philippine question. In this connection, however, I would call attention to the fact that there exists today a world conscience which is sufficiently strong to give pause to any nation, however great and powerful, which would seek to subdue and plunder a weaker people.

Furthermore, this is not a period when the nations of the world care to embark in foreign conquest. The League of Nations, however American entry as an integral part of its organization may be regarded, at least presents evidence of a desire on the part of its members to avoid international friction. Each country is confronted with its own domestic problems, and it cannot be doubted that deliberate

aggression on the part of any power would cause complications which no nation today is prepared to face.

Let us assume, however, for the sake of argument that a stable government means a government which is able to repel or offer an adequate defense against foreign aggression; and let us also admit that no one can forecast the policies of the great powers in the Far East for the immediate future. If this be true the Philippine Islands should remain under the sovereign power of the United States until they shall have acquired the ability to defend their territory and independence against any possible foreign aggression. If, then, the Islands are to remain under the control of the United States, shall American statesmanship further prolong the anomalous and unfortunate situation now prevailing? Should not the Filipino people enjoy the blessings of American traditions and history? Should not the Philippines be placed under a form of government which is truly American in fundamentals and character?

It is most fortunate and extremely gratifying that Colonel Thompson has been in close personal contact with the Philippine situation. He thoroughly appreciates that existing conditions in the Islands are most unhappy and undesirable. I am firmly of the belief that they are merely the natural consequence of a political system founded upon dual sovereignty which is inherently fallacious. It is a system which is liberal in theory only, but in fact is inevitably oppressive. The thirteen American colonies, and later both Ireland and Canada, have passed through a similar situation.

ATTITUDE OF GREAT BRITAIN COMPARED

Colonel Thompson, as the personal representative of the President, regrets in his report the lack of coöperation between the Governor-General and the Philippine Legislature, and has stated that for this reason "very little constructive legislation has been passed with the exception of the annual appropriations and public works bills." This part of his report is reminiscent of that rendered by Lord Durham, Special Commissioner appointed by the King of England to investigate conditions in the Dominion of Canada. In 1838 Lord Durham said: "It is melancholy to think of the opportunities of good legislation which were sacrificed in this mere contest for power" between the Governor and the Assembly. Again Colonel Thompson in his report says: "Business in the Islands is practically at a standstill. Not only is it impossible to obtain new capital but many existing investments are regarded as unsafe. Philippine labor is without sufficient employment and is emigrating to Hawaii, the United States, and other countries." Lord Durham in his report, to which reference has been made, said, "While the present state of things is allowed to last, the actual inhabitants of these provinces (Canada) have no enjoyment of what they possess, no stimulus to industry. The development of the vast resources of these extensive territories is arrested and the population, which should be attracted to fill and fertilize them, is directed into foreign states."

The report of Lord Durham resulted in a complete revision of the British attitude toward the Canadian government, and home rule was granted. Today Canada is happy and prosperous, and today the people dwelling in the Dominion, though still under British sovereignty, are most loyal in their devotion to the mother country. Very recently Great Britain has taken a new and decidedly progressive step in deal-

ing with her dominions. As a result Canada, Australia, Ireland, and the other component parts of the British Empire are for all practical purposes separate national entities. This in itself is outstanding proof of the fact that a policy of domination is not only unnecessary but positively inimical to the establishment of harmonious and mutually advantageous relations between different peoples.

The attitude which Great Britain has adopted with regard to her Dominions has, in fact, been anticipated by the Congress of the United States. No other construction can be placed upon the principles embodied in the preamble of the Jones Law where it is stated that "it is desirable to place in the hands of the people of the Philippines as large a control of their domestic affairs as can be given them without, in the meantime, impairing the exercise of the rights of sovereignty by the people of the United States, in order that, by the use and exercise of popular franchise and governmental powers, they may be the better prepared to fully assume the responsibilities and enjoy all the privileges of complete independence."

With proper safeguards the Filipino people should at least be allowed to formulate their own constitution and elect their own Governor-General.

Surely the American people will not be less liberal than those of England against whom they fought in their struggle for justice and liberty. American statesmanship stands at the threshold of an opportunity to add another chapter to the splendid traditions of this country. The Filipino people are ready and eager to coöperate to the fullest extent.

Our Promises Should Be Kept

By Honorable Newton W. Gilbert
Formerly Vice-Governor of the Philippine Islands

I HAVE been very much interested in these two addresses, particularly I may say in the address of Colonel Thompson because he has just come back from the Philippines and his impressions are new; mine were made through a series of years.

I was out there eleven years. Of course during that time I saw every part of the Archipelago, and thought I knew a great deal about the people, but that was several years ago, and I now have to get my latest information from people who come from there. However, there is not a week passes that I do not see Filipinos and Americans both, coming here from the Islands, and who always come to see me in New York.

When Colonel Thompson was speaking of the Igorote people, a pagan people as he called them (and they are pagans), I thought perhaps you would be interested in my relating an incident which I think discloses something of their character which he praised very highly, and shows the divergence of language in the Philippines.

In the Igorote country the land is divided into rancherias. A rancheria is simply what we would call here a township. When I first went to the Philippine Islands I was on the bench and was a judge at large, having jurisdiction in all parts of the Islands, and was sent through the Igorote country to hold the first courts that had been held in many parts of the same. I took with me a retinue of interpreters, because the language differed from rancheria to rancheria, and also court officers so as to hold court.

I remember I was told before I started on this trip that the language of each rancheria had a word which it would be very useful for me to know, which word was a greeting such as "glad to see you," "it is a fine day," "bully for you," and so on, and I said to the interpreters that I wanted to learn that word at least before I reached each one of these rancherias.

I remember in the first rancheria the word was "mahpud," and so when the chief came to greet me with his retinue, I said "mahpud" and stuck out my hand. He was pleased and said a few words back to me that I had not yet learned, and presented me with an egg. As a rule I was presented with an egg. They always gave me some such present, and I would give them a box of matches, or a paper of needles, or some colored beads. I carried several horses loaded with gifts of this sort which were not very expensive, but would serve the purpose. The word was "mahpud" in the next rancheria, and in the next "maptung." Now that word varied from rancheria to rancheria until in the last one it was "ogeese." I am relating this simply to show how the dialects do differ. They differ vastly.

But I want to tell another incident that happened in one of the last places I visited on that trip. When I came to hold court I found that among the criminal cases was one against a young man of one rancheria, who had been arrested for throwing a spear from ambush and piercing the arm of an old man from the next rancheria. You will remember that these

people were all head hunters before we went there, and we were trying to get them out of it.

This man had been under arrest for two or three weeks and was to be tried. The word went around that I was there, and when I went to the courthouse in the morning (the courthouse being a big bare room) I found outside waiting for me about a hundred and fifty, or two hundred, of the friends of these two parties, all Igorotes of course, none of them clad except in a G-string, tall, bronzed, fine-looking fellows as a rule, each one of them carrying a large spear and a head-axe. There were about seventy-five or a hundred of them representing the young fellow and about the same number representing the old man. I hadn't been there very long, and they didn't look good to me. But they asked me through an interpreter if there was any objections to their coming into the courthouse when the trial was held—to which I said, "Come in, but stack your arms outside." This they proceeded to do, and came in.

Now I remember the friends of the young man all took their seats, if you may call them seats—the Igorotes don't sit on chairs, they squat on their heels. If you give them a bench or a seat of any sort, they get up on it with their feet and squat on their heels. Well, the young man's friends squatted on one side and the old man's friends on the other, and the trial began. There was no dispute about the facts. Under the Spanish law, as perhaps many of you know, when you try a criminal case, if there has been any damage suffered by anybody by reason of the criminal act, you assess that damage in the same trial. It is a much better plan than we have here. Here a man may assault me and I can convict him for that assault, but when I sue him for the damage he has done me, the jury may turn the other way. Out there, however, you can't have that kind of miscarriage of justice. So it was my duty when I found him guilty, which I did, to also assess the damages to the old man whom he had injured.

Well, the old man had been laid up from work for twenty-one days according to the evidence, and at the rate of ten centavos, or five cents a day, which his time was worth, you can readily figure out that the damage was twenty-one times ten centavos, or two pesos and ten centavos, or $1.05. So when I found him guilty and sentenced him to a month or two in jail and to pay the costs, I said also, "Pay the damage done to this old man of $1.05." The chief of the young man's tribe (they were all watching and listening to the interpreter) jumped up and said, "When must this money be paid?" I said, "It is due now, but must be paid before the young man leaves jail." He then asked if he could have time to collect the money. I said he could. He went around amongst his followers, and they fished out of the pockets of their G-strings a penny or two or three until they had $1.05. I directed him to give it to the clerk of the court, who gave him a receipt for it.

I directed the clerk of the court to give it to the old man who had been injured. He was squatted on a bench to the left of me. He was an old fellow, seventy years old, with gray chin whiskers, eagle-eyed, and the clerk went over with a double-handful of pennies and offered them to him. At that he drew back and refused to take them. So I said to the interpreter, "Explain to him what this is. This is what he gets in damages. He wasn't able to work twenty-one days, and here is what he gets for it, so he won't be out anything through being hurt." The

interpreter explained it to him and then again when the money was offered he drew back. I said to the interpreter, "What is the matter with him?" The interpreter asked him, and at that the old man jumped down onto the floor and stood up and made a speech which, being interpreted to me, was like this. He said, "I didn't cause this prosecution to be brought in order to get money out of this fellow. We have our own way of settling these matters, but now this great American government has come over here and they have established some kind of law and a court, and they say the right way is to go into court and have him prosecuted as I have done here. But I don't want his money; I scorn his money. I have great respect for the court, but rather than take this money I'll go to jail myself."

Now I give you that as an instance of the character of those people. I think they are wonderful people myself.

The question which is under discussion is a very hard question to cover in five or ten minutes. I think we've got to look at it from three points of view. I won't try to say which of them is the most important, but we must look at it first from the point of view of the Filipino people; second, from the point of view of the American government; and third, from the world point of view.

Of course it goes without saying that if we should grant at this time, in the condition of the world, independence in the Philippine Islands, there would be an uprising in India, in the Dutch settlements, and a conflagration in the Far East. I think there is no doubt about that, because other people would say, "We are as much entitled to independence as the Filipinos." I won't say that is an argument against independence, but it is a fact, in my judgment. Now I am thinking principally of the interest of the Filipino people. Somebody said to me the other day, "Don't bother with that. It sounds like bunk." It isn't bunk with me. I was there eleven years. I learned to know these people.

You see these men here behind me—and others in the audience—there are no finer people in the world. Nobody has better hearts than the Filipino people. You learn to love them. You learn to care for them. I do, and I appreciate their ambition, but, after all, I've got some consideration for their welfare, and in my judgment to turn these people loose at this time, with their very limited resources, is to create a condition that would be very harmful to them, exceedingly harmful to them. In the first place, they couldn't maintain their independence if anybody chose to take it away from them. They say, "Well, why can't we have neutrality?" Well, Belgium had neutrality, and I don't like that kind of neutrality. You don't know what might happen. They are the only Christian people in the Far East. They are the only people in the Far East where women have any rights and standing and character. The women of Japan, of China, of all oriental countries outside of the Philippine Islands, are slaves. I am not willing to subscribe to any condition that will put the women of the Philippine Islands possibly in that situation.

It isn't such a terrible thing to be connected with the United States. The people of California haven't asked for independence. They have every right in the Philippine Islands that they have in California. They haven't the right of trial by jury, but they have the right under the law to create a law for trial by jury, but perhaps they are not ready for it yet. I am not for independence now because of these reasons, which reasons you see I could

elaborate on if I had the time to do it. It doesn't mean that I shall never be for independence.

I don't pay much attention to the preamble of the Jones Bill. I think the preamble of the Jones Bill, saying they wanted to do something when stable government was established, was, to say the least, silly, because a stable government was at that moment established in the Philippine Islands. Could it be any more stable than it was then? Could the government be any more stable than it was at the very moment that the bill was enacted? That doesn't worry me; but I will tell you what does worry me. Every President of the United States, from McKinley to Wilson inclusive, gave out public statements of some kind that they were going to give the Philippine Islands independence. Of course I know it is true that no President of the United States had any authority to promise for you or me. That isn't within the province of their duty or their powers. But they did, and I am not willing for the Filipinos or any other people in the world to say my country made them promises they are not going to fulfill. And, therefore, I say we must arrange somehow to redeem that promise. While we can't do it now, as I see it, we can, as has been proposed, say to the Filipinos, "We are unwilling to give you independence now, because it would ruin you economically. The $40,000,000 additional you are getting now you are getting by reason of having free entry to the United States. We are not willing to put you in the position of losing that, but we believe within thirty or forty years you can develop these things so that perhaps then you could have independence, if you then wanted it."

And so it has been proposed that we say to them, "We will give you the fullest measure of local self-government now, but we will retain all the powers of sovereignty. We will retain all powers to deal with foreign nations, and retain all powers in reference to finances outside of the Philippines, and when your bonds are paid, as they are due, in less than thirty years, you *then* want independence we will give it to you, but it will be up to you." Now of course my judgment is that when they become developed to that point they won't want it, because they will see the advantages they have by being with us. If they lacked freedom it would be a different thing. They have freedom in every sense that any of us have freedom.

May I refer to just one more thing? Colonel Thompson referred to the fact that the Philippine Islands needed agricultural development. That is certainly true, and there has been no opportunity for that because of what? Because of the fact that the United States Congress, in the early days of our occupation of the Philippine Islands, passed a law which did not permit a corporation to own more than 2500 acres of land in the Philippines. That law has hindered development. That law, passed by our Congress, not the Philippine Legislature, has fixed them so that through all these years they couldn't have the beginnings of the development that they must have. And then Congress recently did a more serious thing. They put into the Jones Bill a provision that the Philippine Legislature themselves could have control of the land laws, when neither Alaska, nor California, nor Arizona have control of their public lands. Those are public lands that the United States owns. They are not public lands of the Philippine Islands; they are public lands of the United States, and so Congress for the moment, at least, has put out of its power the

opportunity to give the Filipino laws that will permit the development of these lands on a large scale.

Men and women, this is an important question; I think it is a great question. We undertook there something we never undertook before. We weren't experienced and didn't know how. We perhaps have made a good many mistakes, but we haven't any mistakes in our hearts. We want to do the right thing. I don't think the Filipinos have any mistakes in their hearts either. They want to do the right thing. They are friendly personally with all of us. They like us. We like them. There ought to be some basis upon which we could get together. We must be sure we redeem every promise we have made at the proper time, and may everybody feel that neither side is at fault in the matter.

The Obligations of Philippine Independence

By Vicente Villamin
Filipino Lawyer and Publicist, New York City

PREPAREDNESS for independence is a proposition of relativity comprehending a multiplicity of conditions and circumstances. Accordingly to the query: Are the Filipinos ready for independence? I reply: They are. But to the less academic and more relevant query: Is it wise for the Filipinos to separate from the United States now? I reply: It is not.

There is indeed in the Filipino people the philosophical foundation of independence, the natural longing to exist as a distinct political organism. Particularly during the last three decades consciousness of country and patrimony has become stronger by the impact of the centripetal force of a resurgent nationalism. Nevertheless, to those Filipinos who would build a nation upon sound and secure foundation the rational preoccupation should be: Would the immediate and complete realization of that longing enrich and invigorate and perpetuate national life?

Why the Philippines Should Not Separate Now

An analysis of prevailing environmental conditions and national psychological tendencies compels a negative reply. This conclusion connotes not fear but prudence, not surrender but common sense. It spells national self-preservation.

To a Philippine nation the problem of international security would be of the gravest character. This embraces the disturbing questions of imperialism, militarization, extraterritoriality, mass immigration, economic penetration, and involvement in the imponderable and turbulent Asian militarized politics.

There is yet no discoverable evidence that the machineries of international conciliation and adjustment, including the League of Nations, have functioned satisfactorily in the Far East. The fetching phrase "world-conscience" is still endowed with as many interpretations as there are countries in the world, multiplied by the number of their respective interests, which signifies *ad infinitum*.

I am expressing a disappointment and not a wish, having especially in mind the contemporary developments in the Republic of China. Certainly with the advent of a better international order, which, let us hope, might soon eventuate, the Philippines would then be justified in going forth as a sovereign nation with more than a Chinaman's chance to exist in tolerable tranquillity.

At present, the choice for the Filipinos is not between American sovereignty and Filipino nationhood, but between America and some other nation. Here I can state, subject to no correction, that the Filipinos are for the United States of America in preference to any other nation the sun sees.

I hasten to declare that if the choice were between Filipino nationhood with its onerous responsibilities and American sovereignty with its well-nigh indispensability I would be, with the consent of all my faculties, for a Filipino nationhood.

He is unfit to live if he believes himself or his country unfit to enjoy liberty. What I am thinking of is the

peace and permanency of the future Filipino nation even as it should go through the peradventures of national independent existence. It is for the Filipinos at this time of opportunity and prosperity, while the friendly and steadying hand of America is extended them, to build well and conscientiously.

Besides the issue of international security, there are vital considerations encompassed in the independence question that only the irresponsible, the thoughtless, and the heartless would ignore.

Separation from the United States means to the Philippines loss of tariff protection, dislocation of industries, depletion of foreign and domestic commerce, increase of invisible debits, dearth of capital and death of credit, poverty, unemployment and diminished labor's compensation, collapse of the exchange position, removal of American support to the Philippine financial structure, increased taxation while the people's tax-paying capacity is reduced to impotence, and the resultant chaos in the social order.

Separation also means exclusion of Filipinos from the United States under the immigration law, discharge of Filipinos from the United States service, loss of American military and diplomatic protection, and addition to the contracted Philippine budget of a heavy item of expenditures for defensive establishments to the detriment of the work of internal economic and social amelioration.

These are facts, not theories, and they are vastly important facts. They concern very deeply the poverty or the prosperity, the peace or the absence of it, of the Filipino people. He little understands the meaning of moral concepts who disregards poverty as a practical moral question of the highest moment and forced idleness as a grave social menace.

For the sake of the Filipino people, the situation should be faithfully surveyed and frankly presented. It can be understood only by disabusing ourselves of the notion that the needs of mortal life can be fully met by merely increasing verbal tonnage, or toying with the totems and taboos of conventional freedom, or asserting hypotheses of no practical application, or nursing an unrequited love for the absolute and the perfect, or brazenly presuming to own a copyright on intelligence and patriotism.

From postulates I move to actualities. A few months ago the Manila cigar industry revised its wages downward. As a result, 4000 men and women walked out on a strike. It was represented that the falling off in the demand in the United States justified the cutting down of the wages.

The workers simply urged the impossibility of living decently on the reduced wage scale, insisting that the former scale was the irreducible minimum. Efforts to arbitrate the question proved unavailing because it was a matter of the demands of life not being arbitrable. The workers struck to preserve their standard of living, and they stuck to their guns until the employers had to give in.

This seemingly unrelated case smokes out the grandiloquent disquisitions about immediate and absolute independence. For if the Philippines should separate from the United States not only would labor's compensation suffer substantial diminution but the majority of the workers would lose their employment altogether. This applies to the major industries of the Philippines—the very prop of the national structure.

POLITICAL *vs.* HUMAN LIBERTY

I am afraid we are exercising ourselves too strenuously over political

liberty. It is human liberty, of which political liberty is but a fraction, that should engage our thoughts more. Government is only an instrumentality for the promotion of collective well-being, with collective conscience as its motor power, reason its guide, and service its objective. Government exists for the people, not the people for government. Its sociological vindication disappears when it becomes a block to progress and a blight on life.

Liberty is not alone a matter of laws and constitutions, but is also a question of compensation of efforts. A man who works without compensation is a slave, and the farther away he moves from that position the nearer he comes to realizing real individual liberty.

Let me revert to the question of political independence. The enlightened and unselfish opposition to it is predicated on the grounds of international security and economic realities, and not on the fiction of Filipino mental incapacity or on a negation of the moral right of the Filipinos to direct their own destiny.

The question of mental capacity is immaterial in deciding upon absolute separation from the United States. For if all the Filipinos were doctors of philosophy, would that fact change the economic needs and the political geography of Japan? Would it alter the political and economic policies of Great Britain in Australasia and the Pacific? Would it open to the Philippines the tariff-inclosed markets of the United States? Mental capacity is only material when considering the degree of local self-government that should be extended to the Filipinos. So let us not lose both energy and temper expatiating upon brain convolutions and their relation to the mechanics of government and politics.

My plea, then, is for the Filipino intellectual, political, and civic leaders to address themselves to the prosaic but essential task of fact-finding and fact-facing in connection with the fundamental political problem of the Filipino people—a task, I daresay, that will accelerate and solidify the now dispersed forces operating towards eventual independence for the Philippines.

I am galvanized to the conviction that until and unless this is done the Philippine problem will continue to be a prolific source of controversy, patrioteering, bullyism, charlatanism and obscurantism, yea, twenty-five years from now, if this learned Academy would retain its interest in the Philippine question, we would again be discussing the question in the same way as now, with the only difference that then our voices would carry the tremor of age advanced a quarter of a century.

As I reach the end of my discussion, I wish to leave this thought: The Filipino people deserve to be intelligently informed and unselfishly led.

We have an undying faith in the great future of our country. I say in all solemnity: From that faith it is death to apostatize!

Democracy in the Philippines

By Vicente G. Bunuan, B.A., B.S.
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THE Philippine problem should be discussed in the light of true and real statesmanship—in a plane far above narrow, petty arguings regarding bribery, bossism, demagoguery, feuds, scandals—for these exist everywhere, even in the most enlightened nations, and will continue to exist until the Millennium is in our very midst. I shall discuss, therefore, the problem from the standpoint of the implantation of democracy, alleged to be a purely occidental product, in a country of Oriental location and origin.

Considering the question from this aspect, I shall start with the premise that not all the ways of democracy which are fit for the peoples of the west because they are of the west are best and the most proper for peoples inhabiting the east because they are of the east. The latter, therefore, should adopt only those basic elements, only those broad principles, only those fundamental practices which have made popular government a success in the countries that have tried it. I contend that this foundation stone of democracy has already been established in our country, and America, therefore, should by granting us immediate and complete independence, permit us to build the superstructure, to work out the details, to direct its growth, to shape its destiny—all in conformity with the traditions and culture of our race; all in accordance with our nature, with our environment, with our climate, with our geography, with our psychology, with our philosophy.

Before entering into an examination of the fundamentals of democracy already implanted in our country, it must first be stated that when America came to the Philippines she found a people with a high degree of culture and civilization, united by the Christian religion and possessed with those finer elements of life which have made Christianity the greatest moving factor in the march of civilization, a people held compact by common grievances against Spain and resulting in common aspiration to free themselves from Spanish domination, and later, still made more compact by common resistance for a period of nearly three years against the superior armed forces of America. These unifying influences far outbalance the disintegrating forces of an alleged multiplicity of dialects which exist more in the imagination than in the realm of fact. Only fancy can conjure "language groups led by language chieftains engaged in internecine warfare" alleged to take place in the event of independence. A people, a Christian people, that can rise as one in response to such patriotic impulse can have no such pronounced alignments. For three hundred and fifty years the civilization of this people had been Malayan and Latin with an admixture of the Chinese. From this meeting of these three mighty influences, there was forged a new type of people, unique in the Orient—a fertile field as it were, for the cultivation of democracy which this great Republic has sought to implant in our country. For a period of twenty-eight years

now, American genius has planted upon that fertile field the basic elements of American democracy which I now invite you to examine with me.

FRAMEWORK OF POPULAR GOVERNMENT ESTABLISHED

First, the framework of popular government, the executive, the legislative, and the judicial, the three pillars of democracy we already have in the Philippines. The overwhelming majority of the personnel of these three branches of government—our municipalities, our provincial governments, our legislative, our judicial and our executive departments—are in Filipino hands and have been functioning with results termed "without parallel in the history of colonization." The framework, I repeat, is there. We would ask you to leave us to work out its details. The adoption of the budget system in the Philippines years before it was adopted in your country, shows that we have the foresight to choose what is good for the efficient functioning of a democratic government implanted near the Equator.

The establishment of points of contact between the executive and the legislative, especially at this stage of the development of our government when the executive is still appointive and the legislative elective, through the heads of our legislature sitting with the Cabinet and the Chief Executive, and through our secretaries of departments appearing on the floor of the houses, both of which are departures from your system, are details which have been found to be effective coördinating forces in our government without lessening the effectiveness of the workings of your theory of separation of powers. It is to be regretted that, temporarily at least, the heads of our legislature no longer sit with our Cabinet and with the Executive. Even with an elective executive, we will, when independent, certainly endeavor to eliminate those details which are deprecated by your own statesmen. I quote Chester H. Rowell, from his second article on "The Next Step in Washington," which appeared in the February, 1925, issue of *The World's Work:*

> America presents in the President the most powerful chief magistrate, in his pseudo-Cabinet the most anomalous council of state, and in the unorganized isolation of Congress the most incongruous legislative situation on earth. The President stands unique. Other peoples have their chiefs of state, kings, or presidents, to embody the sovereignty of the nation, and their premiers or heads of government to lead and administer its affairs. The American President unites these two functions. He both wields the executive power and determines the manner of its exercise. His is the delegated authority of the whole people, controlled only by the written rules of law. It is a combination of powers which monarchies have taken from their kings, and which no other republic has conferred on its president without making him dictator.

WIDESPREAD EXERCISE OF RIGHT OF SUFFRAGE

The next basic element we already have in our country is the widespread exercise of the right of suffrage which is the main cog of popular government. In practically every election held in the past in the Philippines more than eighty per cent of the qualified electors cast their ballots. There is thus universal interest in the affairs of state, which is very significant when one considers that in the last two presidential elections in the United States, only a little over fifty per cent of the qualified electors voted. And our elections, as certified by Governor-General Wood himself, in his

reports to the Secretary of War after each election in the Philippines, "are conducted in the most peaceful and orderly manner and free from fraud and irregularity which would be a credit to any people." We have adopted the main elements of your system of suffrage, but in working out its details we have endeavored, as we will constantly endeavor, to provide those safeguards which will make it impossible for a situation to arise in which the defeated candidate can accuse his victorious opponent of such power of manipulation as to be "able to get the sick to walk, nay, even the dead to rise and go to the polls and vote," both these gentlemen in the particular instance I have in mind, hailing from this very peaceful and God-fearing state of Pennsylvania.

ABILITY TO SUPPORT AN INDEPENDENT GOVERNMENT

The next basic element of democracy we already have in our country is the ability of our people to support an independent government. It is not generally known that we are not now receiving, and since 1901 have not received, financial help from the Treasury of the United States as aid to administration. At present there are many optional activities of the Philippine government which can be dropped for the time being. Also our per capita tax is only three dollars, among the lowest in the world. There are thus several adjustments that can be made to meet in part new burdens of nationhood such as maintenance of consular service and other such details.

It has been asserted that no new sources of taxes can be found until the natural resources of the country are more fully developed. We contend that the granting of independence will be accompanied by economic development. Everybody admits that the reason for the present business and commercial stagnation in the Philippines is the uncertainty of the political future of the Archipelago. The Filipinos are glad that Colonel Carmi Thompson agrees with their contention that it is impossible to bring about any economic development in the Islands until the political status of the Archipelago has been settled. The granting of independence would result in sure and steady economic growth instead of the halting, stunted, arrested, and undefined course it is now taking. And to the contention that an independent government would discriminate against capital already invested and that desiring to invest, we reply that such an argument is untenable by its very illogicity. An independent Philippine government will want to attract rather than scare outside capital, especially American capital, because it is to its own interest that its economic resources are developed and that it secure rather than alienate the goodwill and friendship of America and other nations. A newly organized independent state cannot afford to discriminate against other nations; to do so would be to endanger its newly acquired freedom. And, I might add, the Filipinos, if necessary, would even go out of their way to meet the demands of other countries with regard to investment of capital if those demands are not too entirely out of keeping with their own national interests.

SORDID MATERIALISM DEPLORED

With all respect and reverence to America's tremendous economic growth and to the emphasis she is placing upon our own material development, we want it to go hand in hand with our social, political and spiritual growth. We do not want it to go too far ahead of the things that are intangible, of the things that are of the spirit,

that a situation may develop in the Philippines wherein it may be said that the Filipinos have allowed themselves to be gripped by the spirit of sordid materialism. In this connection I should like to quote President Coolidge in opening the Sesqui-Centennial of American independence held recently in your very city:

> We live in an age of science and of abounding accumulation of material things. These did not create our Declaration of Independence. Our Declaration created them. The things of the spirit come first. Unless we cling to that, all our material prosperity, overwhelming though it may appear, will turn to a barren scepter in our grasp. If we are to maintain the great heritage which has been bequeathed to us, we must cultivate the reverence which they had for the things that are of the spirit. We must not sink into a pagan materialism.

It is also asserted that independence would spell disaster because of stoppage of benefits derived from free trade relationship with America. Those who put up this argument refuse to see that the longer independence is postponed the longer will we be pampered by this artificial advantage. Every year that passes finds us more and more dependent upon it, and the time is sure to come when it will be utterly impossible to extricate ourselves from its luxurious clutches. If independence is to be given later, as those advocating postponement propose, we contend that it should be given now, for the sooner free trade is discontinued the sooner will we get started on our feet.

PHILIPPINE BONDS SECURE

It is also asserted that if the payment of our bonded indebtedness in the United States were made a prerequisite to independence, the Philippine government would have no means with which to redeem them. To any Philippine bondholder we say that we have adopted in the Philippines the actuarial system, a definite and sure way of insuring payment of our bonded obligations. The Philippine Legislature every year appropriates the necessary amount for sinking fund and interest on all bonds that have been issued, and from the time our first bonds were floated our government has never failed to set aside the necessary amount as required by that system. A Philippine independent government would continue with that system merely as one of the routinary acts of government. You will see, therefore, that, independent or not, we are able to meet our obligations when they are due. The creditor has neither the legal nor the moral right to impose the payment of a debt before it is due. To do so would be to place him in a position where he would be regarded as demanding a pound of flesh and with it the blood that oozes out of the life of the creditor. And I may add that if the payment of these bonds is made the price of our independence, the Filipino people will find some way to pay them even before they are due. Other peoples and other nations have sacrificed more for their liberty and freedom. The Filipinos can and will do no less.

THE TREATY OF VIENNA AND THE TREATY OF PARIS

The remark is also made that we would not be able to maintain an army and a navy. I desire to point out that to wait twenty or thirty years from now for our independence would not enable us to produce an army and a navy equal to those of the great powers, or sufficiently large to defend our country in the event of aggression. None of the independent nations of today, with the exception perhaps of two or three of the most powerful, have the army

and the navy to defend themselves and yet they exist free and unmolested. Despite assertions of the prophets of disaster to the contrary, universal peace and amity is greater today than at any time in the world's history. The motives that guided those who wrote the treaty in the Congress of Vienna in 1815, as shown by actual provisions of that treaty, were the partitioning of conquered peoples for the conquering nations. A century later the motive that guided those who wrote the Treaty of Paris which terminated the war which was fought for democracy was the granting of self-determination to conquered peoples by conquering nations; yes, the world is better today than a century ago. As a product of the war that culminated in the Congress of Vienna, the Holy Alliance was organized whose ostensible purpose was the conquest of defenseless territories and submersion of weaker nationalities. As a product of the Great War that gave rise to the Treaty of Versailles, the League of Nations was organized for the avowed purpose of setting up downtrodden territories, re-establishing submerged nationalities with protection for their territorial integrity. I repeat, the spirit that animates our age today is higher and more noble than that which moved the world a century past.

JAPAN AND THE PHILIPPINES

Among the members of the League of Nations is Japan, which is at once invoked as a menace the moment independence is mentioned. You are no doubt aware of Article X of the covenant of the League of Nations which is as follows:

> The members of the League undertake to respect and preserve as against external aggression the territorial integrity and existing political independence of all members of the League. In case of any such aggression, or in case of any threat or danger of such aggression, the Council shall advise upon the means by which this obligation shall be fulfilled.

Cuba, Haiti, Siam, and the Irish Free State have been admitted as members of the League, and it is only reasonable to expect that the Philippines, once independent, will be admitted to membership. I know what some of you are mentally saying regarding the League. Just the same, you cannot but admit that it is an instrument for world peace and justice and an asset especially to small nations unable to protect themselves otherwise from the bigger nations. The Philippines could at least have the protection of the League.

It is asserted that Japan needs the Philippines for the overflow of her increasingly large population. Granting for the sake of argument that there is great need for this overflow of population, the Philippines is not the proper place for the Japanese. It has been shown by experience that they do not thrive in our country, for the climate is too warm for them. This is proven by the fact that there are only about 10,000 Japanese in the Philippines despite the fact that there is no Japanese anti-immigration law, whereas in Hawaii and in the United States, where there are very strict immigration laws, there are, in the former, about 120,000 and in the latter 140,000 Japanese. As a matter of fact, statistics show that there are only half a million Japanese outside the Japanese empire. Japan has room for her people. It is not land that Japan needs, but raw material. Since 1900 the land of the Mikado has been changing from an agricultural to an industrial nation, and in that great fact lies a world of difference. So long as she was a distinctly agricultural nation she was facing constriction and strangulation

for lack of land. As an industrial nation, she has land even to spare. In fact Japan is repeating the transformation of Great Britain after 1846. If Britain had remained an agricultural country, her people would now be crowding one another into the sea. She became a manufacturing country, and by manufacturing, she now sustains a population three times as great as her field area justifies.

Another element of democracy we already possess in our country is the peaceful and orderly nature of the Filipino people, always emphasized by Governor-General Wood in his reports to his superiors, pointing out especially that "even parties of women can travel in the mountain regions unescorted and unmolested." I wonder if our Governor-General could as honestly make the same report were he to describe conditions in Chicago and other great centers of your population. We attach a great deal of importance to the peaceful nature and law-abiding character of our people because every time our independence is mentioned our opponents immediately conjure revolutions.

PROPERTY AND EDUCATION

Another basic element is the distribution of property in the Philippines. There are none extremely rich, neither are there extremely poor in our country, which is noted for the absence of beggars. This is a stabilizing factor of democracy. You can well sympathize with us in our struggle against the possession of our national wealth by outsiders or by Filipinos themselves in unlimited quantities.

The degree of education of our people is another contributory basic element that we already have. Our literacy is sixty per cent higher than the literacy of thirty-six of the fifty-five independent nations of today. Education is spreading, and today nearly five million of our population speak the English language. This spread of education will go on even with your absence from our shores.

THE PSYCHOLOGY OF THE MORO SITUATION

Opponents of independence refer to the Moros as elements which the Filipinos would be unable to handle once the Philippines are independent. This argument has gained momentum since Mindanao became known as the richest spot on earth for the growing of rubber, simultaneous with which discovery a movement was started looking toward the segregation of that region from the rest of our Archipelago. With this in view our opponents have been constantly ringing into the ears of the Moros their being fearless, valiant, and brave; their never having been conquered by the Filipinos of the North; their being their traditional enemies; and their being promised protection by the United States against the Filipinos. You can well imagine the psychological effect of this upon the mind of the picturesque, therefore highly imaginative, Moro. His dormant instincts to resist, to hate, to kill are aroused and so today, with the exception of the large group of Moros that have stood through thick and thin with the Filipinos in their stand on the independence question, animosity instead of amity, friction instead of friendship, alienation instead of attraction, govern the relations between Mohammedans and Filipinos. Even now a prominent Moro leader is entrenched with his band in the mountain fastnesses defying constituted authority.

Now, let us turn to the period when the Filipinos were permitted to handle the Moro question and before Mindanao became a tempting rubber prize. The policy adopted was to bring Filipinos and Moros into friendly relation-

ship, in order to bring about mutual assimilation. So, at the outset of the Harrison administration, military régime was substituted with civil rule. No talk of strife, feud, traditional hatred was indulged in. On the other hand, the spirit of friendship and amity was emphasized, as it should be. So after the inauguration of this policy the Moros became amenable to peace and order and a flourishing period of mutual friendship and assimilation ensued. Their leaders themselves, formerly bitter enemies of both Americans and Filipinos, were clamoring for public schools and other such blessings which the new order was more than ready to extend to them. I desire to emphasize that it was not until 1914, during the period of Filipino autonomy under Governor-General Harrison, that the first appropriation amounting to 204,523 pesos and later another appropriation of one million pesos for primary schools were made. By 1919 there were 32,438 pupils in the public schools of Mindanao and Sulu. So successful was this policy of bringing the two peoples into brotherly relationship that when America entered the World War in 1917 it was not considered dangerous to withdraw not only the American soldiers stationed there but also the Philippine Scout garrisons with the exception of one battalion stationed at Pettit Barracks at Zamboanga. This is what the Filipinos can do if they are allowed to handle the Moro question unhampered; that is what they will do when they become independent in dealing with the Moro problem.

LASTING DEMOCRACY WITHOUT THE SUPERFICIALITIES

Thus the fundamentals of democracy as a result of coöperative and mutual assistance between America and the Philippines we already have in our country. We now ask you to let us direct its growth. For you will agree with me that in working out the details and fitting them to a people's peculiar nature and environment, only they know what is best for themselves. The American, no matter how good-intentioned and how wise he may be, cannot profess to know the Filipino better than the Filipino knows himself. Much of the friction, unpleasantness, and mistakes in the administration of the Philippine government today would be avoided, were there not too much interference in the shaping of the local and intimate affairs of our body politic by America. In this connection, may I cite, one of your greatest, if not your greatest living statesman, Elihu Root in an article in *Foreign Affairs*, entitled "A Requisite for the Success of Democracy":

> The organization of independent nations is the outgrowth of progress in civilization which leads people to shape their local self-government according to their own ideas. Whatever may be the form of local governments, there can be no tyranny so galling as the intimate control of local affairs of life by foreign rulers. National independence is an organized defense against that kind of tyranny. Probably the organization of nations is but a stage of development, but it is the nearest that mankind has yet come towards securing for itself a reasonable degree of liberty with a reasonable degree of order.

Our position is clear. The framework is already established, we now ask to be permitted to build the superstructure; nay, may you not, permit me to be frank and say that we would have the basic elements of your democracy but none of the superficialities of that democracy, the virile elements of American civilization but none of the strappings and by-products of that civilization so well described by the Rev. Mr. Fosdick when he said:

"Freedom and abandon in our country may be summed up in the following: in art we have cubism; in poetry we have free verse; in music we have the jazz, and in almost everything else, we have 'do as you please.'" It has been correctly stated that the people of a colony have a tendency to imitate those of the mother country. In the Philippines some of our girls are already adopting the typically American bob and shingle and dancing the jazz and the Charleston and later, maybe, the black bottom. If I may speak in a lighter vein, we would not wish to make our very pleasant association with you too long that the time will come when our women will no longer regard woman's tresses as her crowning glory in harmony with her exquisite native costume and with the splendour of her Oriental setting, and her conception of the dance no longer one in which every motion is poetry and every movement of the limbs and body no longer an asset to woman's grace and beauty.

I would not consider complete my small part in this discussion did I not express the gratitude of 12,000,000 Filipinos for the many blessings that have come to them as the result of their fruitful association with this great Republic. And may I add that my people would be infinitely more happy if America, by granting us our coveted independence, ruled not in a land with geographical limitations but in the boundless empire of the heart of a grateful people.

The Demands of the Filipinos — Is the United States Meeting Them?

By Marcial P. Lichauco

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WHEN I was working in Geneva this summer with Professor Hudson of the Secretariat of the League of Nations, I had the occasion to participate in a conversation which Dr. Hudson had with an American visitor of wide repute regarding the advisability of America's entry into the World Court. Our distinguished visitor, himself a staunch supporter of that Court, seemed to be impressed, however, with the strong oppositions of Senator Borah and Senator Reed particularly, because in his opinion these two outstanding figures in the United States Senate were men of sterling character and high sincerity.

Dr. Hudson's reply is particularly applicable to the Philippine question and my attitude to the utterances of those who speak against the Philippines. "Why of course these men are sincere," said Dr. Hudson, "they are all sincere. The trouble is that they base their arguments on a wrong premise."

The Attitude of the United States

The American people have for twenty-eight years in a more or less disinterested and half-hearted manner sought to settle the Philippine problem. And they have been doing this on one premise, namely, that the people of the United States, a conscientious and unselfish people having no interest in view save the welfare of the Filipinos, have had the Islands thrust on their hands "unsought and decidedly unwanted." Those are the words employed by the President himself, and that by virtue of this trust they are duty bound to control the Islands absolutely and to decide eventually two things—first, whether the Filipinos are ready for independence, and second, whether independence is good for them.

Now, that is a very fashionable and gratifying attitude to take, but it is one which unfortunately cannot face the test of history.

There is probably no student of American history today so greatly respected as James Ford Rhodes. In his well-known treatise on "The McKinley and Roosevelt Administrations," these are his conclusions regarding the Philippine problem: "It is true," writes Mr. Rhodes, "that McKinley was inconsistent in his public words," for in his message of December, 1897 (i.e. to Congress), he had said "forcible annexation . . . cannot be thought of; that by our code of morality would be criminal aggression!" And yet "one cannot read the proceedings of the Peace Commission in Paris," adds Mr. Rhodes, "and see in any other light than that our taking of the Philippines was 'forcible annexation.'"

A Harvard Professor of great prominence, commenting on this finding, curiously enough has added that McKinley's most credible biographers have been unable to bring forth any evidence to the contrary effect. And the list of American students of history writing in a similar vein is indeed an imposing one. I shall not dwell on the

three years' resistance offered by Filipinos themselves and the resulting era of cruel and bitter conflict that characterized it, of the thousands of lives sacrificed in battle, and of the villages that were burned and the lands laid to waste. They are memories which we would fain obliterate.

The words of Senator Lodge, however, may not be inappropriate. "We make no hypocritical pretense of being interested in the Philippines solely on account of others," he said. "While we regard the welfare of these people as a sacred trust, we regard the welfare of the American people first. We believe in trade expansion." These words were uttered by the late Senator as chairman of the Republican Convention in 1900 which re-nominated McKinley. They were uttered in the presence of one thousand delegates from every state in the Union, and not one man entered a single word of disclaimer.

This is all a record of history, which those who discriminate would be willing to grant; it is an unfortunate incident which American citizens of independent thought (there are a few of them left) are willing to admit, and having admitted it may still wish either to retain the Islands because of the commercial advantages to be found there, or reach a settlement compatible with Filipino demands and the prestige of this country. I am afraid, however, that we would have extreme difficulty in having the Senate of the United States look at these facts, or much less give them the consideration they deserve.

THE COMMERCIAL VALUE OF THE ISLANDS

What now of the pressure being brought to bear on the settlement of this question by the commercial interests of this country who would profit from the retention of those Islands? I trust you have heard enough about rubber and hemp and sugar interests and of the activities of the American Chamber of Commerce from the Philippines, who are operating a well-conducted propaganda urging the nation to take definite steps to retain the Islands, or put off the settlement of that question for an indefinite period of time. Nor is the interest of this nation in the Philippines limited to these private individuals. Even Congress is now awakening and taking a lively interest in the Islands as a source of tropical products essential to Americans, and a few members of that august body are openly advocating annexation of the Islands to maintain the dignity and commercial prestige of the United States in Far-Eastern affairs. As may be recalled, a special inquiry was recently made by the Committee on Interstate and Foreign Commerce of the House of Representatives to show the dependent condition in which America finds herself with regard to tropical products, and the necessity in Secretary Hoover's own words, of your building up "free sources of supply" for reasons of "far-reaching importance."

We cannot ignore this one fact, we cannot evade it, and we cannot escape it. This country today, more than ever before, is becoming convinced of the tremendous asset which those Islands would mean to you, and from all directions we find forces getting under way, the results of which cannot but be reflected in any of the feeble attempts made to find a solution to the Filipino demands.

Gentlemen have accused me of talking about sentimentalities and idealism instead of practical statesmanship. But, on the contrary, this whole Filipino problem has been in the past conducted by the American Adminis-

tration on grounds of sentiment instead of practical statesmanship, the sentiment which has made you believe in the ability of those in whose hands lies the destiny of the Filipinos to settle this problem entirely for the benefit of the Filipino, regardless of the only too evident advantages which Americans would lose by withdrawing from these Islands. What has this form of statesmanship brought you? The delays which have characterized the definite settlement of the problem have brought discontent and distrust among those whom you expected to bless, or at least you believed would or should receive your suzerainship as such. The other nations of the world, too, are beginning to believe that your utterances of benevolence and altruism were but mere blinds to conceal your real desires to implant yourselves deeply in those Islands, because of the commercial advantages to be gained there. And what can we say of the lost confidence on the part of China, India, and other exploited countries, who at one time had gone so far as to believe that you were the champions of subject people?

A WAY OUT

I suggest that in place of these sentimentalities your country should adopt a practical form of statesmanship. I suggest that you admit to the Filipinos the interests which you have in maintaining some form of control or authority in those Islands. We Filipinos are also a practical people and, recognizing your interest and the relations which have bound us together for so many years, we will, I feel sure, make some concessions compatible to your needs and to our present demands.

No one realizes more than I do the greatness of this vast Republic, and few can be more impressed with the necessity of entering into relations with her in the future developments of our life. But these relations must be carried out on a footing of equality. There can be no friendship and no true understanding when one country is not merely coerced, but is actually in a position of dependency, subject to the will and command of an alien Congress sitting 10,000 miles away from the scene of its operations. I suggest this form of practical statesmanship in place of the one which you have blindly followed, and which still asserts that this country has no interests in the retention of the Philippines, and that these Islands were placed in your control as an incident of war "unsought and decidedly unwanted." You remember what a Frenchman said in describing the tactics of an English statesman who was seeking to justify England's control of Egypt and India on humanitarian grounds. "I don't mind seeing a man with a card up his sleeve," he said, "but I can't bear it when he tells me that it was God who put it there."

One final word of observation. Assuming that you decide to make a prompt and definite settlement of the Philippine question by granting the Filipinos a greater share of self-government, but short of Filipino demands for absolute independence, can you do it by passing a bill in Congress sponsored by a member of that legislature? My opinion is that you cannot, any more than the English people were able to settle Irish demands by discussing and passing innumerable reform bills in the House of Commons.

The Irish demands were satisfied compatible with English interests, and the Filipino demands can be met compatible with American prestige and interests in the East, only when delegations representing both countries have met in conference around a table with the light of public opinion focussed upon them. Only then can we

reach a settlement that will satisfy us both.

The demands of the Filipino have already been made known to you in every conceivable form and manner as complete, absolute, and immediate independence. Those are our aspirations, those our aims, and those are our interests as we see them. It is for you to tell us yours, and to lay your cards down on the table—face up—as we have already done.

ARE THE FILIPINOS READY FOR INDEPENDENCE?

A Symposium

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